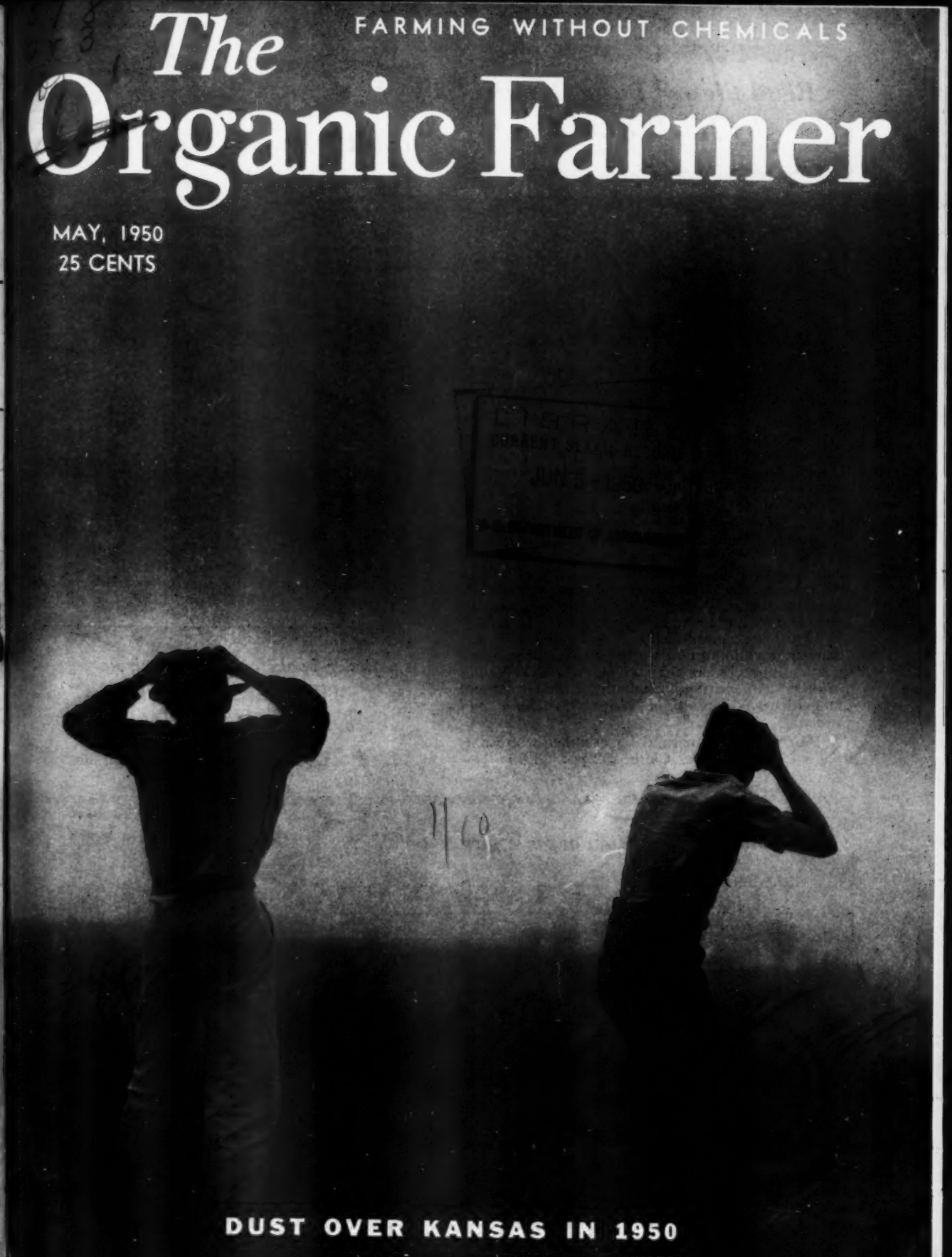
FARMING WITHOUT CHEMICALS

The Organic Farmer

MAY, 1950
25 CENTS



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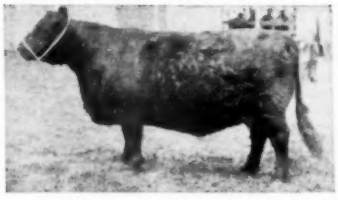

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May, 1950

The Organic Farmer

Farming Without Chemicals

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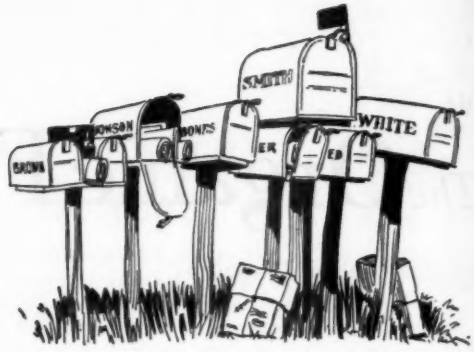
Letters



Super Yields

Dear Sir:

You have undoubtedly read the article "Signposts Toward Super Yields" written by John Bird in the April 1950 issue of *Country Gentleman*. If you have not read it, please do so.

I subscribe to your magazine and to *Organic Gardening* and have found great pleasure, in an amateurish way, in following the organic method on a couple acres of land. Because of my inexperience and lack of an adviser I have failures as well as successes, but with my own hands and sweat I raise fruit and vegetables that are delicious to the taste and ample in quantity for my family.

The article in the *Country Gentleman* distresses me in that I feel it points to a dead end and if that is true the article might be a pitfall for many farmers. The caption "A field is like a factory where crops put raw materials together to make food and fibre. As we aim for yields above the soil's natural capacity, we must feed additional raw materials to the assembly line.", seems to me to be almost contemptuous of the laws of nature which, after all, are the laws of God.

Harold H. Haight,
Syracuse, New York.

Report from Rhodesia

Dear Sir:

When we started growing citrus here some forty years ago we went in for clean cultivation. This soon, however, gave way to interplanting with cover crops, chiefly legumes, which were plowed in. Later the disk harrow took the place of the plow as the plow went too deep and destroyed the surface roots of the citrus trees.

This change took place perhaps some 20 years ago, so that from that time we have really been practicing what you call the New Organic Method. We did not know what actually was taking place, as now explained by Dr. Dhar, but we are quite satisfied that the method is effective because we have proved it over a number of years.

I wonder if the aerobic nitrogen fixing bacteria, azotobacter, also plays a part in the fixation of atmospheric nitrogen at the same time? We have always imagined that it does.

Our purpose is to get as large a bulk of legume vegetation as possible to disk in, and to break this up properly we disk harrow across the field two ways. The result is that quite a lot of material is incorporated in the first one or two inches of the soil and quite a respectable mulch is left on top. We get a great deal of powerful sunlight and our idea has always been that this moisture-retaining mulch is protecting the surface from the fierce rays of the sun, enabling the nitrogen fixing bacteria to do better work. Of course, we get the benefit of the nitrogen fixed by the legume roots no matter what happens on the surface.

Farmers should examine these nitrogen nodules carefully. It has been found that not all nodules are effective so that planting a legume which produces non-effective nodules is no better than planting a non-legume. The way to tell is to cut through the nodule and observe its color. If it is of a reddish or brownish color, then it is 100 per cent effective. If, however, it is of a dirty white or greenish color, it is not much good. Grow a few of the different legumes in some pots or tubs close at hand to test them.

We found that the soy bean always gave lots of nodules and of a good color. It is probably one of the best plants to use in a test and a couple of beans in a pot on the window sill make an interesting experiment.

See that the soil is inoculated. To do this, put just a tiny bit of soil in the pot from a field on which soy beans have recently been grown, or use a commercial legume inoculant.

I mentioned in a previous letter the question of aerosols as a source of plant food from the atmosphere. In a reply to one of my letters to an English Journal on this subject, a correspondent asked if the potash in the air is a sulphate or a muriate. The answer is that it is neither. Electrolytes like potassium chloride are ionized and exist as separate ions of potassium and chlorine, each carrying an electric charge. I rather

wonder that this question of aerosols has not been further gone into in your country.

How for instance do orchids manage to exist without soil or fertilizer and flourish on air and rain alone. As regards your "New Organic Method," it is many years ago since Sir Albert Howard discussed sheet composting with me. We have used this method for years now.

Is it not really just another form of turning vegetive matter into humus. We now use sheep to help us. We grow a heavy leguminous crop between our citrus trees and in some groves instead of disking this in we hurdle off small portions and let a flock of sheep sleep in the pen. Next morning everything is trampled flat and it is mixed with the solid and liquid wastes from the sheep. This method of feeding roots and other crops has been in vogue for many, many years, but I am afraid with modern mechanical methods it is generally falling into disuse.

The trouble apart from that is that many of your readers do not keep sheep. Last year we found that the trees in the rows that had been treated in this way set two crops of oranges in the year instead of the normal one. The explanation is beyond us, but when the matter was put up to one of your leading biological institutions they suggested it was due to a vitamin B complex. If one has the stock and the facilities the mixing of the vegetable matter with manure would seem to be better than using the manure alone.

How true is the saying that there is nothing new under the sun. Are we not really reverting by degrees to those methods that were in use in England and elsewhere before the use of artificial fertilizers was ever heard of.

Captain J. M. Moubray,
Rhodesia.

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Bridgeton 22, Indiana

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that only trees can make the earth habitable for man. They are the true guardians of fertility. They peg down the soil. They are the sponges that control the floods and channel the water to the reservoirs. The fences that break the wind and hold the soil from blowing away, the home of the insect balancing birds, and even multiply the clouds and govern the climate.

For the last forty-three years we have used sawdust and shavings as bedding. Since learning the use of mulching and composting we have been using it to great advantage in the garden and in the field. We find that a topdressing with well rotted sawdust is a great help to new grass seedings.

At a recent meeting of the Virginia-Carolina section of the Forest Products Research Society, held at Duke University, Mr. A. C. McIntyre, Chief, Regional Forestry Division of the Soil Conservation Service, Upper Darby, Pennsylvania, gave a most interesting talk, "Wood Waste as a Soil Conditioner." "Wood is cheap organic matter," said Mr. McIntyre. "Farmer experience has shown the worth-whileness of using sawdust and shavings as mulch, barn bedding, chicken litter, a composting substance, or to maintain or increase soil organic matter. I have visited some of them and their fields and soils give evidence of good husbandry. They are not the farmers who believe in the Old Wives Tale that 'wood makes soil sour and acid.' They have learned that quite the contrary is true and this fact is further substantiated by research."

Mr. McIntyre went on further to say, "Soil organic matter serves as food for various types of desirable soil microorganisms. It supplies essential elements for re-use by succeeding plants. It aids in improving the physical qualities of the soil. Its presence as living or dead material on or in the soil aids in the control of erosion by wind and water. In mulch form it increases water intake, reduces water loss, lowers soil temperature, insulates the soil against early or quick freeze thus protecting

worm populations, absorbs the energy of rain drop impact thus reducing erosion, acts as a barrier to flowing surface waters, and aids in eliminating competition of weedy plants.

Arnold G. Ingham,
Wellville, Virginia.

Queries and Comment

Dear Sir:

For the past several months I have been subscribing to your magazine, *The Organic Farmer,* and have read your articles with a great deal of interest.

I am the owner and operator of a large truck farm at Fishkill, New York, and have felt for some years that chemical fertilizers were not the answer for the continued fertility of the soil. In the fall of the year, all the land is planted to green manure crops which, up until last year, consisted entirely of winter rye. In the fall of 1948 I found that through constant cropping and raising of the shallow rooted cover crop (rye), we were experiencing a definite compaction of the soil. As of that time we planted several fields of sweet clover, allowing same to reach the blossoming stage, and then returned the same mass back to the soil. This, I believe, has helped immeasurably, as we are once again getting drainage and capillary action on the fields involved. It is now our earnest intention to plant one half the acreage each fall with the deep rooted sweet clover, the other half with rye.

Like many truck farmers, it is difficult for me to take land out of production in order to rest the soil, but with the above treatment accord-

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ed the land, do you believe we can build the organic content of the soil which has been unquestionably depleted over the past years even though liberal supplies of chemical fertilizers have been supplied?

For your information the farm consists of approximately two thousand acres, and is given over primarily to the production of snap beans, with a small percentage of acreage planted to sundry other vegetable crops.

Stephen W. Blodgett,
Fishkill, New York.

The green manuring program that you describe seems extremely good. However, we would suggest that, since you have to keep your land in production at all times, you try to obtain as much organic matter from outside your farm as possible, which could be used as a mulch. It has been found that mulches are more effective as yield boosters than green manure.

Dear Sir:

Can you hold the nitrogen in poultry manure by sprinkling it with rock phosphate?

W. J. Rapier,
New Orleans, Louisiana.

Yes. There is no reason why rock phosphate shouldn't do the job. See the article "Fertilizer Teamwork" in this issue for more on this subject.

Dear Sir:

How does colloidal phosphate compare with other fertilizers? Do you recommend its use.

Theo Spindler,
Plymouth, Wisconsin.

There is a difference of opinion among fertilizer men as to the relative value of colloidal and rock phosphate. Some say that the colloidal phosphate has two-thirds the phosphate of the ground rock and should therefore cost two-thirds as much. Others say that colloidal phosphate is finer than rock phosphate and therefore is more readily available to the plant. We recommend both types, but we are in the process of conducting tests to find out which actually is better.

With the Editor

A Case Against Chemicals

MOST of the opponents of the organic method of farming admit that the use of organic matter is needed in farming, but they sometimes do not go out of their way to obtain organic matter in their own farming operations. They will use chemical fertilizers and green manure crops and if they happen to have animals—some manure, but they do not have the advantage of the organic farmer who will seek organic matter outside the confines of his own farm. This comes about usually because of a long time dependence on chemical fertilizers and a chemical fertilizer mentality. At the end of the year it means less money in the bank for the chemical fertilizer user and a less fertile farm. Let us go into the question of organic matter versus chemical fertilizers.

Organic matter retains moisture. In a year of drought it pays for itself over and over again. It furnishes nitrogen, phosphorus and potash to the soil. It furnishes also the minor elements and the trace minerals. It aerates the soil and prevents hard pans and soil erosion. It increases the bacteria and the earthworm populations. One of the reasons why organic matter reduces disease may be the result of the multiplication of earthworms which feed upon it. The earthworm chews up the soil. Charles Darwin said that practically the entire topsoil goes through the digestive system of earthworms every few years. In this manner it digests and inactivates the eggs of disease-producing organisms and insects. Organic matter darkens the soil, which increases its ability to absorb and retain heat. This is an important factor in crop-growing. Organic matter loosens the soil and makes it easier to cultivate. It enables you to plow when your chemical-using neighbor cannot.

The great expert on humus, Dr. Waksman of Rutgers College, says that the mere presence of organic matter acts to reduce or inhibit disease. This lessening of disease may be due to the penicillium and other antibiotic organisms that it causes to multiply.

But chemical fertilizers are not good for these little policemen of the soil who keep the disease producers in check.

Another important thing about organic matter is that it is the roughage of the soil. Just as it has been shown that the human stomach requires roughage, so does the soil. For millions of years, in nature, plants have grown with the aid of humus, the roughage created from decaying plant and animal matter. Now comes the aspirin age and men who wish to feed the equivalent of pills and powders to the soil. Just as we need ham and eggs and not synthetic food in pill form, so the plant must have the equivalent of ham and eggs—manure and leaves and weeds and corncobs, or it will revolt eventually. The process of such revolting is now underway.

The most important benefit of organic matter in the soil, however, and one that is usually overlooked, is that the process of making the unavailable trace minerals of the soil available is tied in with the organic matter of that soil and it is only through organic matter that such minerals can become available. This concept is so axiomatic that there can be no argument. I have at least 50 references from agricultural textbooks and scientific papers that state this unequivocally.

It was found that when the tractor replaced the horse and less manures were used, the problem of deficiencies of trace elements—boron, copper, manganese, zinc, cobalt, vanadium, etc. became pronounced and exceedingly troublesome. Then the solution attempted was the feeding of the needed trace elements to the soil in an available form. But the difficulty here is that they must be present in such small quantities—sometimes 4 or 5 parts per million, that even a slight overdose creates serious damage.

Let me give you one of my fifty references on the vitalness of organic matter to trace element availability. Professors Truog and Berger of the University of Wisconsin said that after testing 34 virgin and 48 cultivated soils, they found that the

A Case Against Chemicals

Continued

organic matter in the soil made boron available to plants. The use of chemical fertilizers seems to make the trace elements unavailable. These deficiencies are beginning to affect seriously the nutritional qualities of our food. The International Harvester Company has become alarmed over it. They claim that fat, juicy steaks aren't what they used to be, nutritionally speaking, placing the blame on lack of available trace minerals in the soil. This company has financed an investigation by the Armour Research Foundation at the Illinois Institute of Technology, to find whether this is true.

Organic Matter—They are words which every farmer should paint on his barn in letters ten feet high—to always keep before him as a reminder.

What is happening to the organic matter content of our soils? It is decreasing dangerously close to the vanishing point. The other day, I was sitting opposite a young man about 18 years old in a railroad dining car. He was going to be inducted into the Army. We got into conversation and I found that he had lived all his life on a farm. I began to describe the organic method to him, but I noticed that every time I mentioned the words "organic matter", he raised his eyebrows, so I asked him if he knew what organic matter was. He shook his head. No, he did not. Perhaps on their farm they called it by a different name. But I drew out of him the fact that on their farm they used only chemical fertilizers and green manure crops, using no manure. But work in the experiment stations is showing that where only chemical fertilizers and green manure are used, the organic matter content of the soil is not maintained. Something more is needed.

Now, let us get into the subject of why we do not recommend chemical fertilizers. There are many reasons.

They harden the soil. I have seen the use of organic matter dramatically unharden it on my farm and on many other farms. When we bought our place, because of the hard soil, the rains that landed on Mr. Havir's farm above us came rushing onto ours. Our own water was added to it and the combined rainwater went rampaging over to the Creveling place. By that time they had come to flood proportions. Today, with the combined effect of organic and contour farming, we take all of Mr. Havir's water as well as our own rains and use it all on our own farm. We do not send a thimbleful of it to the Crevelings anymore. Think what this would mean in the reduction of flood damage, if the whole country followed our method. You can see this very graphically today on our farm in another way. When it rains heavily, farms near us form ponds where there are bowl-like formations, showing how hard the soil is. We have similar places on our farm where such ponds used to form, but not any more. The rain is absorbed quickly into the soil. This must be seen to be appreciated.

Chemicals or uphill plowing can cause disaster.

Now comes the most important part of this article and I present this as my main evidence in the case of the Organic Method against the chemical:

Chemical fertilizers leave dangerous residues in the soil. There always seem to be two parts to every chemical fertilizer—one good and one bad. The plant uses the good, but the bad fraction remains in the soil and becomes refractory later on. To give an example:

Superphosphate—It consists of the phosphate rock (which is the good) and sulphuric acid (which is the bad). The plant uses the phosphorus but needs only a tiny amount of sulphur. The sulphur portion therefore remains in the soil. One of the bad things about sulphur, of many others, is that it causes sulphur reducing bacteria to multiply which work on it to reduce it. These sulphur reducing bacteria have to feed, and part of their diet is a certain fungus whose function is to break down cellulose in the soil. It is a vicious cycle. Sulphur therefore multiplies a bacteria which destroys certain badly needed fungi. The use of superphosphate, therefore, causes an unbalance in the microbial population of the soil.

Let's take muriate of potash. The plant takes the potash but it takes little of the chloride which has come in through the hydrochloric acid put into this fertilizer. The concentration of the chloride ion in the soil is a factor that is well recognized as ad-

versely affecting the germination of seeds.

Nitrate of soda. In this case the plant takes the nitrate but not much of the soda. The sodium combines with carbon to become carbonate of soda which is washing soda. A small amount of washing soda may not be too harmful but when nitrate of soda is used year after year it is no wonder that such soils eventually become as hard as concrete. Practically every other chemical fertilizer is the same. You have to take the unwanted portion along with the wanted portion. The cumulative effect of the unwanted part may become disastrous.

I could rest my case against chemical fertilizers right here, but there are many other reasons why chemical fertilizers should not be used. An important one is that they do not increase yields as popularly supposed. They will do so on land low in organic matter that has been abused, but the records will show that with the consistent yearly addition of organic matter, over and above mere green manure crops, yields will exceed those where chemical fertilizers are used. I have much evidence on this point, but space will not permit its submission here. In the current issue (March) of *What's New in Crops and Soils* published by the American Society of Agronomy, Dr. Richard Bradfield of Cornell said "Organic matter is the best yardstick to measure the soil's fertility. By improving the soil's organic matter supply, crop yields can be greatly increased." The yields on my farm are 40% higher than average, and getting better each year. We use organic matter plus ground rock fertilizers, not chemicals.

Consider the mystery of the shrinking oranges. A California newspaper says—"California growers are baffled by the strange dwarfism that has overtaken their valencias."—These oranges are getting smaller and smaller each year until they are now the size of golf-balls. The advertising agencies of the orange-growers are hard put as to how to advertise these little fellows, so they say—"Midgets are loaded with juice. Buy a big bagful of small oranges." But those growers who are following the organic method out there are taking prizes. I can mention Dr. Koentopp, one of our readers in Santa Ana. He gets the prizes for size and juice content every year with his organically grown oranges. We get our organic oranges from one of our readers in Orlando, Florida. Last year I submitted some of them, together with the same variety grown with chemical fertilizers obtained from the man's neighbor, to the Pease Laboratories, New York City. The organic oranges had 30% more vitamin C.

California and Florida use terrific amounts of chemicals. One of our readers in California who has some farm land to rent wrote us that he would not rent it out unless the renter agreed to follow the Organic Method. One applicant said he couldn't do that but would agree to use chemical fertilizers sparingly. His idea of sparingly was one ton of chemical fertilizer to the acre.

If it were not for the development of hybrids and the constant improvement of varieties, yields would be terribly low today. Now here is a strange thing about the development of new varieties and hybrids. The plant geneticists go to some primitive country like Guatemala, or Puerto Rico, where chemicals have not caused the varieties to run out. There they find a plant that has been growing under natural conditions. It has vigor and life and they cross it with some American variety. Then it is hailed as a great development, but you are not told that they are covering up the previous failure whose yields have declined and which is full of disease. A peculiar thing is happening, however. There are two different departments now going to these primitive places. In addition to the geneticist there is also someone who is trying to teach the natives to use chemical fertilizers. If they succeed, where will the future geneticist get his primitive plants? The chemical fertilizer will cause the potency of primitive varieties to reduce themselves just as our varieties here do.

Wheeler MacMillan of the *Farm Journal* has recently admitted that the use of chemical fertilizers has not increased yields. He gave figures as of today compared to sixty years ago. We are barely holding to the old averages today, he said, *with* our chemical fertilizers and *with* our new varieties.

There are a dozen other reasons why chemical fertilizers are not good. One of them is that soluble potash has a tendency to cause an increase in the carbohydrate of plants, thus

(*Continued on page 37*)

The words Organic Farming and erosion repel each other.

Restoring a Worn Out Farm

This farm went from good to bad and back again.

By A. P. THOMPSON

THIS is the story of the restoration of a worn-out Virginia farm. It is a story that some day must be written about thousands of farms throughout our great nation.

The little farm which constitutes the theme of this story is located in the great and historically famous Shenandoah Valley of Virginia. It is in a beautiful valley stretching from Harper's Ferry on the north to Roanoke on the south—bordered on the east by the Blue Ridge and on the west by the Allegheny's. It is about 160 miles long and 40 miles wide.

The land in the valley has been farmed—or shall we say "mined"—for almost 250 years.

My forefathers cut the virgin trees from this land and found that the soil beneath them was rich in plant food accumulated over thousands of years. Their harvests were plentiful, and large mansions sprung up in abundance. The children who were raised on this soil were vigorous, and many great minds went forth from it to shape the Constitution and government of this great democracy.

As the years rolled by, production from this fertile land grew less and less, and it's initial fertility was lost through careless tillage and mining of the soil.

By the time of the Civil War most of the vast timber that once covered it was either cut or burned off. The top soil from the hills had found its way to the sea. Only on the flat surfaces did there remain most of the fertile soil, so the comeback was slow and painful. Many of the homes were abandoned or sold, and those families who remained on the hill land barely made ends meet.

Such is the history of so many of our farms in this beautiful valley. Such is the history of my little farm—the subject of this article. I could write volumes about this land, for I am the fifth generation of our people who farmed it.

I bought this 45-acre farm in 1944 while I was in the Armed Services. Prior to the purchase I rented the place from 1939 to 1944. When I moved on it, the land was grown to sour grass, berry vines and scrub pine. Great red clay galls lay bare over 1/3 of the fields. I plowed about 10 acres of what seemed the best of it, and planted corn; the yield was so light it hardly fed a cow. The stalks were small and lifeless, and only 3 or 4 feet high. In 1940 I broadcast Korean lespedeza over it, and took a job with a branch of the Armed Services, deciding I could not possibly make a living on it at the time. I left the lespedeza to grow and go to seed; in fact, this was all I did to the land until I returned from overseas in the fall of 1945. The lespedeza grew well on all except the clay galls. In a few places there it would grow during the summer—die in the fall, and all growth would wash away that winter, with this cycle repeating itself year after year.

When I returned in 1945, I was determined to build the land up. I had read volumes of pamphlets on how to grow crops and build up soil. These pamphlets were issued by various fertilizer companies and the government. It all seemed so simple then—I had the impression that one's crop yield was simply a function of rainfall plus so many pounds of this and that formulae fertilizer and that was all there was to it, the ground just providing a medium to get the plant root to the chemical. On the basis of this knowledge, it all seemed so simple. All I had to do now

TODAY—Mr. Thompson's farm looks like this. Its soil is rich and productive, and a heavy organic growth that has been disced into the soil is evident across this entire 45-acre stretch. The straw shown in the distance is destined to be used as mulching material for young trees. It is alive with earthworms.

YESTERDAY—It looked like this—dry and sterile, the product of many years of abusive farm practices. The area in the foreground is almost devoid of vegetation, at the right is evidence of erosion and beyond this lies a sparse growth of broom sedge and foxtail. A good growth of trees, their roots in virgin soil, form a startling contrast in the background.

Restoring a Worn Out Farm

Continued

was to have a soil analysis, from the land "formulae" supply the missing chemicals, and I could raise 100 bushels corn per acre with ease! Fortunately I made a chance acquaintance with Louis Bromfield's book, *Pleasant Valley*. It just happened a neighbor had the book, and during a visit he asked me if I would like to read it, which I did. This was the first time that I became acquainted with the benefit of organic matter to soil. Here was an idea from a man who rebuilt worn out land with what we now know as "sheet composting". After reading this book I decided to abandon the idea of raising corn, and concentrate on building up the land. As a start, I would turn under the accumulated growth of five-years of lespedeza, broom sage, foxtail, berry vines, and other weed growth, rebuilding the land first.

With great difficulty this growth was turned under in the fall of 1945. The following spring I decided to sow a variety of grasses and fertilize them. At the time it didn't dawn upon me that it might be too acid for legumes. The literature I had read didn't emphasize this point enough to impress me, but indicated fertilizer was the main substance to add. I rolled the fertilizer on—about 500 pounds per acre of phosphate—sowed a mixture of alfalfa, sweet clover, mammouth, alsike, some brome and rye grass and some oats.

Soon afterwards all of it germinated—it looked like I had an excellent stand, but by July it was another story—about all that survived was the mammoth clover, alsike, grass and oats. What a disappointment that was! What was the trouble? I cut the oats and they yielded about 18 bushels per acre and didn't look too good either. After talking with farmers around, I decided that where I slipped up was in not adding lime. I sent a soil sample for analysis, and it indicated that the land was very sour (pH 5.1) and being of clay structure would require about 7 tons of ground limestone rock per acre to sweeten. Whereupon, that fall (1946) I broadcasted 315 tons of agricultural limestone rock.

The following spring, growth was luxuriant, and in July I sheet composted by mowing the entire field and letting the clippings lay. The growth was so high in places that it was over one's head. Especially pleasing was the growth of brome. It took hold on those bare galls, and it stopped erosion.

Late that fall I decided to plow the entire place, turn under the heavy organic growth, and set the land out in apple trees, using brome and alfalfa as a cover for the middle.

In October I commenced to plow under the clippings and fall growth of clover and grass. First, I tried a disc plow, but the root growth was so heavy and bound the soil so tight that the land lay on an edge, and I realized I would never get it worked to a firm seed bed. I tried a mold board plow only to discover the growth jammed under the plow beam. Finally, after discing one way and then at right angles, the mold board would turn it. In November I drilled in 1½ bushels brome per acre with 5 pounds alfalfa seed, using 2 gallons of oats to feed the brome seed through the drill, and set out the apple trees in December.

In digging the holes for the trees, I found a layer of dark loamy humus over an inch thick, with many large earthworms. This was the first time I had noticed earthworms in this soil.

In the spring of 1948, the growth of oats and brome was a sight to behold! Farmers just wouldn't believe I had only sown 2 gallons of seed per acre. I combined the oats with a yield of 20 bushels per acre, an excellent yield for such a sparse seeding and with no artificial fertilizers.

The total expenditures for ground limestone on this 45 acres amounted to $1,062.00, which includes broad-

casting. The expenditures for commercial fertilizer were $1,880.00. I believe now I could have practically omitted the fertilizer item and that the ground limestone would have sweetened the soil and allowed the legumes to grow with the resultant savings.

This statement is made from an observation of portions of the land where the fertilizer truck didn't reach. There was no discernable difference in growth except the spotted legume leaves indicating boron deficiency.

There is no doubt but that the earthworm fits in our organic cycle. You will find that nature will start them for you, once organic matter has been supplied to the soil. The earthworm is especially necessary on farms that are mechanized and animal manures are no longer available. Manures seem to furnish certain enzymes and bacteria that vitalize plants. I don't believe that sheet composting of green manures will be a complete answer to the maximum production unless animal manures are used.

Establishing a permanent manure factory by using earthworms is relatively simple, and you can work all organic wastes through these creatures. The manures produced by earthworms abound in capsules or eggs that will hatch out on the land and greatly increase their population over that which would take place naturally, thereby allowing you to bring the land up to maximum productivity in a relatively short time.

A heavily mulched apple tree whose reaction to organic methods is being observed.

Mr. Thompson's Virginia farm.

At present I have two 8 x 4 x 4 wooden boxes containing about a million breeders each. Every 30 days the first foot of manure (castings) is removed from these boxes and used to inoculate the apple trees. Later it is planned to excavate a pit about 200 x 40 x 2 in which several million breeder worms will be added, and all organic refuse from the farm will be placed in this pit for production of manure.

With tractor manure loaders it is relatively easy to handle large quantities of manure, and it is surprising how much organic material one can pick up, if he looks around a little. Some examples of surplus organic matter are weeds, corn cobs, fodder, sawdust, grain mill cleanings, and by-products from canneries. A pit should be located in a well-drained spot on the farm near an adequate water supply so that it may be periodically watered. Provision should be made to obtain a source of nitrogen to feed the bacteria that break down the cellulose such as animal or chicken manures. Such a "manure factory" completely eliminates the dependence on artificial fertilizer, and completes nature's organic cycle. Not only will profits increase,

(*Continued on page 47*)

DUST AGAIN

By ROBERT RODALE

Acme

NATURE is now in the process of assaulting 13 years of soil conservation work in the wheat belt. It has been more than a decade since the terrible dust storms of the 'thirties died down and rain began falling again in normal amounts. Wheat farmers have had plenty of time to try to find some way to protect themwheat crop. It revised its December estimate of the 1950 winter wheat crop from 885 million bushels down selves against the whimsies of the weather. If the present drought continues—and we hope it won't—we shall soon know if dry farming is a business subject to control or merely a calculated risk.

Opinion on the possibility of extensive topsoil loss varies considerably. Farmers themselves are not too worried. "Speculation that the new drought had the earmarks of the dry spell that teamed up with wind to touch off the dust bowl disaster of the 'thirties was regarded as idle conversation by veterans of the dust bowl," reports the Denver Post. Secretary of the Interior Oscar L. Chapman supports the no-danger view. "We have at our disposal," he says, "weapons with which to combat any drought-sparked return of the dust bowl." But Louis P. Merrill, a regional director of the Soil Conservation Service, is insistent that there is critical danger of a full-fledged dust bowl in a sector of the grain belt embracing 2,600,000 acres.

The Department of Agriculture, in its April 1 crop report, also expressed doubt as to the safety of the to 763 millions. These figures are evidence of concrete damage to the wheat as the result of soil blowing, but they don't even hint at the small yields of the years 1934-36 when practically no wheat at all was harvested in some counties.

New tillage machines and the practice of fallowing every second year to build up moisture are the wheat farmers strongest weapons against dust. If the "black blizzards" do return in their former intensity, the blame will probably rest on those farmers who stuck to the tools they knew best.

Subsurface tillage (*The Organic Farmer, January,* 1950) is reported to be the most effective wind erosion preventer. It is the only method of seedbed preparation that leaves all stubble on the surface—where it will do the most good. The sweeps or knives of the subsurface tiller rip up the soil to a depth of as much as six inches without disturbing the normal soil layers. Most important, the wind-stopping straw is left on top where it will not decay as quickly as it will when mixed with the soil. Comparative tests have shown that subsurface tillage allows more water to be caught and preserved during the growing season than any other method and that summer fallowed land absorbs the most water when subsurface tilled.

Many wheat farmers, however,

have shied away from subsurface tillage because it is sometimes difficult to plant through a heavy trash mulch.

The use of spring tooth chisels penetrating to over a foot is accepted by many dry land farmers as a conservation practice, but its value is not as clear cut as is that of the subsurface tiller. Some say the narrow ditches left by the chisels allow water to penetrate the soil. Others say they carry water away.

Some people also doubt the value of the one way disk plow, used by thousands of wheat farmers. Although it does leave some trash on the surface it buries a great deal, thereby reducing the wind fighting value of much of the stubble. Fortunately, the standard moldboard plow, a tillage tool with practically no erosion fighting qualities, is now in disfavor and its use is decreasing.

Giant plows that cover blowing topsoil with clay subsoil have been able to stop erosion, but their use has been far less extensive than the publicity accorded them. Most farms aren't big enough to support such equipment, and the cost of custom work is high.

Fortunately, the farmers of the wheat belt are aided in their battle against erosion by the fact that they have gained an intense interest in soil conservation because of their former experiences. It is interesting to note that some authorities feel that if there is another serious dust bowl it will be brought on by farmers who came to the dry country after the drought and have gained their experience in the years of above normal rainfall since then.

Dry farming is a tricky business and quite a bit more risky than most other types of cultivation. Wheat is about the only cash crop adapted to many dry farming regions. There is little opportunity to rotate crops profitably. In other words, dry farming is a one way affair—everything going out and not much going in, even chemical fertilizers.

Early wheat belt farmers took off the cream. Their plows turned over a humus-rich sod that supported heavy crops of wheat. Fabulous are the tales of the wheat barons, men with their thousands of acres and vast armies of men and equipment. Many are still operating today, but the dust storms of the 'thirties and of this spring are rather apparent signs that the land is wearing thin.

Acme

Lawrence, Kans., March 29. With headlights on, cars crawl along U. S. Highway 24 at a speed of five miles-per-hour as a dust storm sweeps across the Midwest.

Where Rain Comes From

An argument for controlled lumbering

By JACK VAN CLUTE

THE DAY before writing this I asked six men of Seattle, where rain comes from. Their answers varied slightly, but all pointed to this—"Why, from ocean clouds, of course." They were about seventy-five per cent off, for incontrovertible evidence based on years of scientific study tends to show that forests, plus evaporation from the land, supply the greater portion of our rainfall.

The direct relationship of trees to rainfall was made a matter of official record in 1927. But since that record reposes in official archives at Washington, D. C., it's small wonder that the man on the street might be so far off on precipitation's source.

Before going further let's introduce one of the world's outstanding authorities on the subject—Dr. Raphael Zon, scholar-professor-scientist, now 75 and living in St. Paul, Minnesota. Born in Simkirsk, Russia, he received degrees of Bachelor of Arts and Science from schools there, followed by postgraduate work at L' Universite Libre, Brussels, Belgium, and Long University. Arriving here in 1897 he became naturalized six years later. After getting a professional degree of Forest Engineer from Cornell University he started as student assistant in the U. S. Forest Service at a salary of $400 per annum. From 1923 until he retired in 1945 he was Director of the Lake States Forest Experiment Station covering Michigan, Wisconsin and Minnesota during which time he was a professor at the Universities of Minnesota and Wisconsin. Now he is consultant for United Nations Food and Agriculture Organization. Listed in *Who's Who,* he has authored over 200 scientific publications, many being translated into French, German, Russian and Japanese—all of this in the case the reader feels inclined to doubt. Dr. Zon's booklet, *Forests and Rainfall in the Light of Scien-*

Forest Service Photo

REFORESTATION OF BURNED LAND WILL INSURE THE FALL OF NORMAL AMOUNTS OF RAIN ON SURROUNDING LAND.

tific Investigations, is based on personal research and study of other world experts including Prof. Eduard Bruckner of Europe. And what does Dr. Zon say about trees and rainfall? A line lifted bodily from a page in his book reads:

"Prof. Bruckner estimates that the peripheral regions of the continents are capable of supplying seven-ninths of their precipitation by evaporation from their own areas."

Broken down into layman's terms, that line means that each country, under certain conditions, could supply 77 per cent of its own rain fall—that every barrel of rainwater hitting New York should have only 13 gallons coming from ocean clouds, with 47 gallons from land-formed clouds! That's it— SEVEN-NINTHS of our rainfall coming not from the ocean but from the land itself! If that proportion doesn't hold, then what's the matter? Lack of forests and vegetable cover, and lack of proper methods of soil management. But since the book was printed 27 years ago, why aren't its facts more universally known? The most logical reason is that it's buried in federal files. Perhaps we shouldn't blame the man on the street for being off on rainfall.

Needless to say, Dr. Zon's theories were attacked at first. But now, like Einstein's, they have come to be widely accepted in scientific circles. He points out that trees, sending roots to great length and depth, are great factors in increasing evaporation from land and in building up cloud formations. Supporting this statement he cites three years of careful observations made by Dr. Franz R. von Kohnel at the Austrian Experiment Station, showing that in one day an acre of 115-year old oaks absorbed from 2,227 to 2,672 gallons of water, corresponding to .09 and .115 inches of rainfall daily. Since the leaf, or vegetation period of the oaks was around five months, the amount of absorption would equal 11.7 inches of rain, seemingly drying the ground in a hurry.

However, that doesn't mean that

Forest Service Photo

BELIEVE IT OR NOT, THE LAND SUPPLIES MORE RAIN THAN THE OCEANS.

Where Rain Comes From

Continued

all the moisture taken from the soil never gets back to it. Far from it. Of the vast amount pumped up by trees, only a little goes to tissue, the rest being released to the air by transpiration. Hence, most of the forest mist is from its own making. "Small clouds are frequently observed hanging persistently over forested areas in the presence of fairly strong winds," says Dr. Zon. "If all the moisture given off by the forest could be visible as a fog, heavily forested areas would appear enveloped by a damp mist. While the above figures are only approximate, (observations of Dr. Hohnel) they give an idea of the enormous quantities of water given off into the air by trees, which has justly given them the name of the 'Oceans of the Continents.' The condensing capacity of many tropical forests is so great that during every clear, still night, drops of dew fall continuously as in rain. This is also the case of the redwood belt on the Pacific coast."

In the Amazon forest it starts raining regularly each day, an explorer told me. Of an early morning one sees the sun shining through a thin, wraith-like vapor rising from the dense vegetation. The vapor thickens into clouds and soon rain starts falling.

Dr. Alfred Angot, studying rainfall in the Iberian Peninsula, says, "It is certain that if the mountain ranges between the Sierra Nevada and Sierra Segura were wooded instead of being absolutely bare and dry, the precipitation in that part of Spain would be increased and there would be no fear of the floods which at times occur in the basin of the River Segura." By the same token were it possible by some magic carpet method to transplant overnight a huge portion of the Amazon forest in the Mojave, the Great American Desert would have rain.

When I asked Dr. Zon if a tree may be likened to a big circulatory pumping plant, he replied: "That expresses the gist of the whole matter."

Elaborating on a balance sheet the circulation of water on the earth's surface, Dr. Zon says: "An analysis of these figures discloses the fact that one-fifth of the entire vapor on the earth's surface comes from evaporation on land; that only seven per cent, or 5,997.5 cubic miles, of all the water evaporated from the oceans enters into the precipitation over land; and that 78 per cent of all precipitation that falls over the peripheral land area is furnished by the land itself."

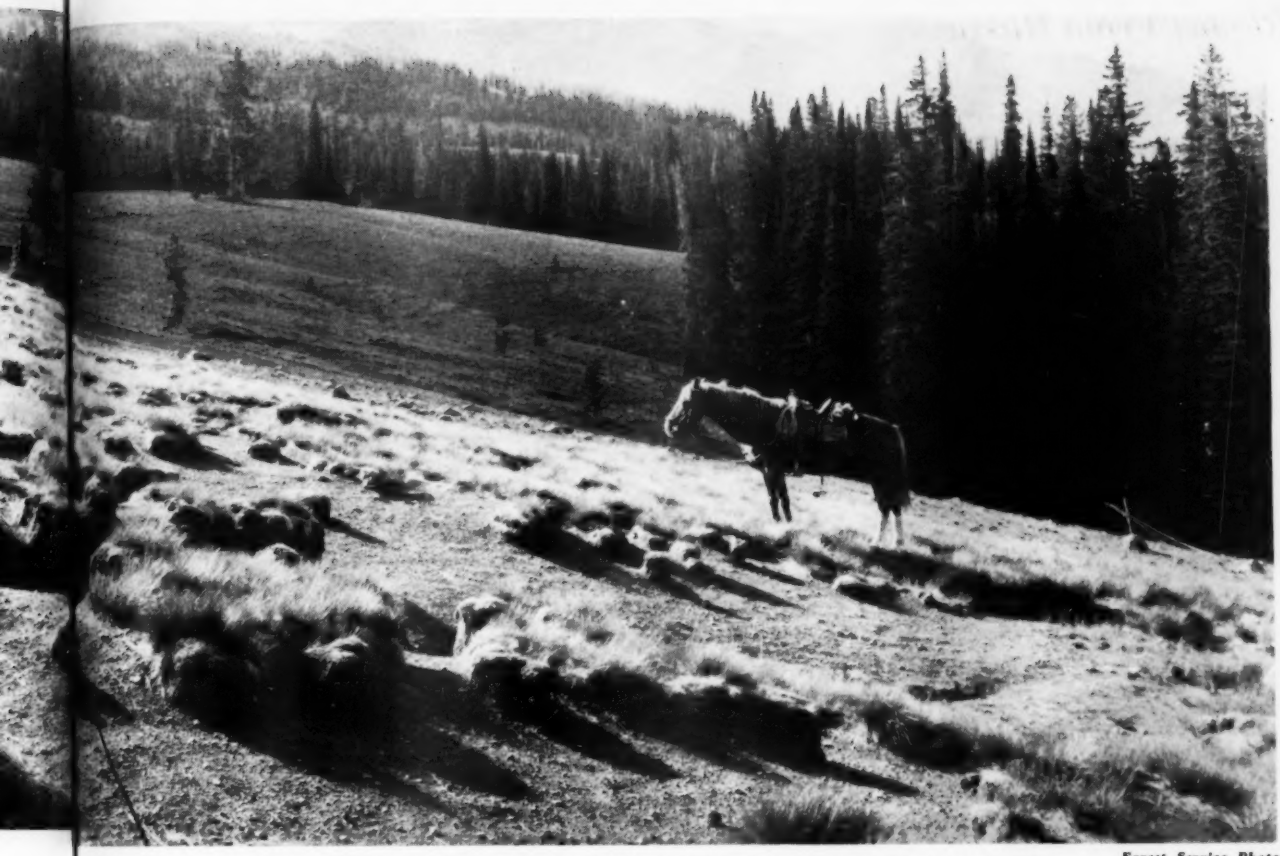
And where is land evaporation greatest? Every organic farmer knows, and others have guessed it—right on bare land. And here's where, over twenty years ago, Dr. Zon entered a word for organiculture: "Soils covered with dead vegetable matter evaporate moisture more slowly than a bare soil or an open water surface." Under certain conditions evaporation on bare soil may become so great that the land is left barren, as a desert.

But the man of Manhattan, out of the timber and worrying about assurance of a permanent water supply, must he grin and bear it? Not always—if steps are taken to provide and protect trees on headwaters of the city supply, and if organic methods in general are followed along the Atlantic seaboard. The Bronx cliff dweller looked out the window for rain last winter because his forebears didn't look out to see whether a tree grew in brooklyn or thereabouts.

Suggestions for remedying the situation, both light and serious, were showered on Mayor O'Dwyer during the water shortage. In response to his constant vacationing he was told not to look in Miami or Bermuda for water. But in all seriousness, civic leaders throughout the country today should look to the land source of their water supply, be that supply deep wells or running

streams. Are trees still there? And are farms well maintained, or are they chemically treated, resulting in compacted soils bouncing raindrops toward the nearest ditch?

Over two score years ago one H. A. Paine wrote right close at home. In reporting to the National Conservation Commission, he stated: "Springs near Odessa, N. Y., have had their flow cut fifty per cent as a result of forest depletion." At that time the Commission survey showed that springs all the way from Maine to New Mexico were dried up or running dry, all due to forest removal. Trees once made running springs and, given the chance, trees can make springs run again. Of course any tree planting program would be too slow to fill the bathtub next Saturday night But coming generations will find use for a tub, surely, and unless proper measures are



THIS EROSION SCARRED HILLSIDE COULD MAKE SOME MAN'S CROPS GO THIRSTY. *Forest Service Photo*

taken, future civic leaders will be plagued by the same problems in the same place.

In an article appearing in *Science* some forty years ago, Dr. W. J. McGee wrote: "During a period of 22 years 9,507 wells in Illinois, Indiana, Iowa, Minnesota, Wisconsin, Michigan, Ohio, Kentucky and Tennessee show a lowering of the water table at a minimum mean rate of 1.315 feet, or, with moderate allowance for new wells, 1.73 feet per decade, corresponding to a total of 13.8 feet for the 80 years since settlement began, "adding that the loss was due largely to increased run-off in freshets and floods with damage to life and property. "Innumerable springs and small-source streams have disappeared," he reported, "and the regimens of nearly all streams have been impaired."

Records show that droughts are inclined to cycles. But blaming a drought on a cycle, or calling it an act of God, doesn't help the man with a parched throat. The seven-year famine in Egypt of old was called one, too, but Pharoah was ready for it because he had looked ahead during the lush years for the days to come. Our land and forest conservation methods have been largely forced upon us by necessity. It's late, but not too late for taking measures insuring the next generation a better break.

In forestry circles Dr. Zon's conservation recommendations have been given wide recognition, but why haven't they been extended, made to apply to farm as well as forest land? The answer is, first, his booklet is purely a scientific exposition. And second, the endless files on parade forbid exploration! The federal government stores enough records to fill not one, but six Pentagons! If the layman wishes to read *Trees and Rainfall in the Light of Scientific Investigations* he first must tap the right shoulder along the Potomac, and even then he may have to say the magic word.

Dr. Zon, an advocate of Nature's way in our national economy—which is the way of organiculture—was named at the New York World's Fair in 1940 as one of 600 foreign-born citizens who, during the last 100 years, had made the most notable contribution to American democracy. Are we profiting as we should by his life's work? The organic farmer who uses shelterbelts to protect his crops, provides trees to protect springs and prevent soil erosion, and replenishes soil humus to make his land more like it was when the settler found it is trying to profit by what science has found to be true.

Fertilizer Teamwork

Here is a way to bigger yields at no extra cost.

TODAY, it is not at all fashionable to write about technical or scientific advances in the Soviet Union. In fact it can be downright dangerous. However, *The Organic Farmer* is willing to concede that the Russians have at times come up with a good idea or two. That is why we are going to flout the rules of journalistic good taste and tell our readers about some interesting Russian experiments reported by one N. P. Mamchenkov in *Soviet Agronomy* in 1946.

Practically all farmers know that if superphosphate is spread on manure, the nutritional elements of the manure will be locked in and loss will be minimized. But we have always suspected that rock phosphate will do the job too—more economically and without introducing the sulphur from the superphosphate into the manure. Well, an agency of the Russian government had a similar idea and even went so far as to conduct experiments. They found that if manure and rock phosphate are mixed together in the animal's pens or after it is removed, the resultant "compost" will have more fertilizer value than equal amounts of manure and phosphate rock applied separately. But let's let Mr. Mamchenkov tell the story himself:

The Federal Institute of Research for Fertilizers of the Soviet Union has worked out during the last few years a method of transforming into compost manure and phosphate flour (phosphate rock), making possible to a considerable extent the rational utilization of manure.

The technique of preparing said compost is very simple and may easily be carried out on any "Kolchos" or "Sov-Chos" (collective farms). The essence of this method is that 2 per cent of phosphate flour is carefully mixed with the manure before storing it in the manure reservoir or open stable. The best mixing of the manure with the phosphate flour can be brought about as follows: Before cleaning out the manure from the cow, horse or hog stables, a corresponding quantity of phosphate flour is spread about. Subsequently the process of cleaning the premises goes ahead in the customary order, and as a result a most perfect mixture of the manure with the phosphate flour is brought about. For each grown up head of cattle the daily dose of phosphate flour varies between half- and three-quarters of a pound.

A less perfect mixture of the phosphate flour with the manure is attained when the phosphate flour is spread by layers on the manure at the time of storing it away in the reservoir or field stable When keeping cattle in unheated sheds, a common practice in the keeping of cattle kept at the personal disposal of collective farm members, the phosphate flour is spread each time before new litter is brought in.

As a result of the reciprocal action between manure and phosphate flour, the fertilizing action of both is increased. Under the influence of phosphate flour the manure ripens more quickly, its degree of humidification rises and the ability of the plants to absorb nitrogen from that manure is increased. The phosphate flour in turn, under the influence of the processes taking place in the manure, becomes also more assimilable by the plants.

It has been shown by vegetation

Sovfoto

A mountain of phosphate rock in sub-arctic Russia.

and field experiments that manure turned into compost with phosphate flour has a much higher degree of fertilizing power than the same quantity of manure and phosphate flour introduced into the soil separately.

(At this point, Mr. Mamchenkov describes several experiments in detail. The results are summarized here and converted into American units of weight and measure for the convenience of our readers: Potatoes raised on unfertilized soil yielded 97 bushels to the acre. When manure and phosphate rock were introduced separately, the yield jumped to 145 bushels per acre. Finally, when the compost of manure and prosphate rock was applied, the yield increased to 158 bushels per acre. The author apologizes for the poor yields in general, attributing them to an unusually dry year.)

Comparing the crop yields, we see that yields were higher with manure transformed into compost with phosphate flour than with a like quantity of manure and phosphate flour introduced into the soil without any previous transformation into compost.

Through more detailed investigations which it would be inconvenient to present in this article, it has been determined that as a result of the transformation into compost of manure and phosphate flour, the mobility of the latter's phosphorus is sharply increased, and as a consequence, the phosphorus utilized by the plant increased by 150 to 200 per cent.

How can we explain the fact that the ability of plants to absorb posphorus from phosphate flour is increased as a consequence of its transformation into compost with manure? Research in this direction has led to the following conclusions:

1. In the decompostion of manure a part of the phosphorus of the phosphate flour is transformed into organic compounds in the body fluid of the microorganisms.

2. The manure on the occasion of its compost treatment forms a considerable quantity of ammonia, potassium and other metal humates. As a result of the action of these humates with the phosphate flour there are formed on the one hand insoluble humates of calcium and on

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Retreat Before the Parasite

An account of a cold war against pests.

By SIR ALBERT HOWARD

From An Agricultural Testament

NATURE, by means of soil erosion removes an area of worn-out land and recreates new soil in a fresh place. Mismanagement of the land is followed later on by a New Deal, as it were, somewhere else. A similar rule applies to crops: the diseased crop is quietly but effectively labeled prior to removal for the manufacture of humus, so that the next generation of plants may benefit.

Mother earth has provided a vast organization for indicating the inefficient crop. Where the soil is infertile, where an unsuitable variety is being grown, or where some mistake has been made in management, Nature at once registers her disapproval through her Censors' Department. One or more of the groups of parasitic insects and fungi—the organisms which thrive on unhealthy living matter—are told off to point out that farming has failed. In the conventional language of today the crop is attacked by disease. In the writings of the specialist, a case has arisen for the control of a pest: a crop must be protected.

In recent years another form of disease—known as virus disease—has made its appearance. There is no obvious parasite in virus diseases, but insects among other agencies are able to transmit the trouble from diseased to apparently healthy plants in the neighborhood. When the cell contents of affected plants are examined, the proteins exhibit definite abnormalities, thereby suggesting that the work of the green leaf is not effective; the synthesis of albuminoids seems to be incomplete. With the development of special research laboratories, like that at Cambridge, more and more of these diseases are being discovered and a considerable literature on the subject has arisen.

The virus diseases do not complete the story. A certain number of maladies occur in which the apparent cause is neither a fungus, an insect, nor a virus. These are grouped under the general title—physiological diseases: troubles arising from the collapse of the normal metabolic processes.

How has agricultural science dealt with the diseases of crops? The answer is both interesting and illuminating. The subject has been approached in a variety of ways, which can be briefly summed up under the following four heads:

1. The study of the life history of the pest, including the general relation of the parasite to the crop and the influence of the environment on the struggle for supremacy between the two. The main object of these investigations has been to discover some possible weakness in the life history of the pest which can be utilized to destroy it or to protect the plant from infection. An impressive volume of specialist literature has resulted. As the number of investigators grows and as their inquiries become more exhaustive and tend to cover a rapidly increasing proportion of the earth's surface, there is a corresponding increase in the volume of print.

2. The study of the natural parasites of insect pests, the breeding of these animals, and their actual introduction whenever this procedure promises success. A separate institution for this purpose has been founded at Farnham Royal in Buckinghamshire.

3. The protection of the crop from the inroads of the parasite. As a rule this takes two forms: (1) the discovery of insecticides and fungicides and the design of the necessary machinery for covering the crop with a thin film of poison which will de-

stroy the parasite in the resting stage or before it can gain entry to the host; (2) the destruction of the parasite by burning, by the use of corrosive liquids like strong sulphuric acid, or by germicides added to the soil so that the amount of infecting material will be negligible.

4. The framing and conduct of regulations to protect an area from some foreign pest which has not yet made its appearance. These follow the usual methods of quarantine. Importation of plants and seeds is prohibited altogether, introduction is permitted under license, or the plant material is inspected and fumigated at the port of entry. The principle in all cases is the same—the crops must be protected from chance infection by some foreign parasite which might cause untold damage. As traffic by land, sea, and air grows in volume and becomes speeded up, it will be increasingly difficult to enforce these regulations.

It is impossible even now to inspect all luggage and all merchandise and to prevent the smuggling of small packets of seed or cuttings of living plants. Indeed, if an investigation were to be made of the personal effects of the coolies passing backwards and forwards between India and Burma, India and the Federated Malay States and Ceylon, it would be seen what an extraordinary collection of articles these men and women carry about and how frequently plants and seeds are included. Enthusiasts in gardening often collect plants on their travels which interest them. The population, live stock, and factories of Great Britain are partly supplied with seeds from all over the world. By one or other of these agencies a few new pests are almost certain from time to time to enter the country. These quarantine methods therefore can never succeed.

More than fifty years have passed since the modern work on the diseases of plants first began. What has been the general result of all this study of vegetable pathology? Has it provided anything of permanent value to agriculture? Is the game worth the candle? Must agricultural science go on discovering more and more new pests and devising more and more poison sprays to destroy them or is there any alternative method of dealing with the situation? Why is there so much of this disease? Can the growing tale of the pests of Western agriculture be accounted for by some subtle change in practice? Can the cultivators of the East, for example, teach us anything about diseases and their control?

It is a well-understood principle in business that any organization like agricultural research, which has grown by accretion rather than by the development of a considered plan, stands in need of a periodical critical examination to ascertain whether the results obtained correspond with the cost and whether any modifications are needed in the light of new knowledge and experience. I began such an investigation of the plant and animal disease section of agricultural science in 1899 and have steadily pursued it since. After forty years' work I feel sufficiently confident of my general conclusions to place them on record, and to ask them to be considered on their merits.

I took up research in agriculture as a mycologist in the West Indies in 1899, where I specialized in the diseases of sugar-cane and cacao and became interested in tropical agriculture. Almost at once I discerned a fundamental weakness in the research organization: the mycologist had no land on which he could take his own advice about remedies before asking planters to adopt them.

In 1905 I was appointed Imperial Economic Botanist to the Government of India. At the Pusa Agricultural Research Institute, largely through the support of the Director, the late Mr. Bernard Coventry, I had for the first time all the essentials for work—interesting problems, money, freedom, and, last but not least, 75 acres of land on which I could grow crops in my own way and study their reaction to insect and fungous pests and other things. My real training in agricultural research then began—six years after leaving the University and obtaining all the paper qualifications and academic experience then needed by an investigator.

Non-spray Pest Control Experiments

At the beginning of this second and intensive phase of my training, I resolved to break new ground and try out an idea (which first occurred to me in the West Indies), namely, to observe what happened when insects and fungous diseases were left alone and allowed to develop unchecked, and where indirect methods only such as improved cultivation and more efficient varieties, were employed to prevent attack. This point of view derived considerable impetus from a preliminary study of Indian agriculture. The crops grown by the cultivators in the neighborhood of Pusa were remarkably free from pests of all kinds; such things as insecticides and fungicides found no place in this ancient system of agriculture. I decided that I could not do better than watch the operations of these peasants, and acquire their traditional knowledge as rapidly as possible. For the time being, therefore, I regarded them as my professors of agriculture. Another group of instructors were obviously the insects and fungi themselves. The methods of the cultivators if followed would result in crops practically free from disease; the insects and fungi would be useful for pointing out unsuitable varieties and methods of farming inappropriate to the locality.

It was possible for me to approach the subject of plant diseases in this unorthodox manner for two reasons. In the first place the Agricultural Research Institute at Pusa was little more than a name when I arrived in India in 1905. Everything was fluid; there was nothing in the nature of an organized system of research in existence. In the second place, my duties, fortunately for me, had not been clearly defined. I was therefore

Retreat Before the Parasite

Continued

able to break new ground, to widen the scope of economic botany until it became crop production, to base my investigations on a first-hand knowledge of Indian agriculture, and to take my own advice before offering it to other people. In this way I escaped the fate of the majority of agricultural investigators—the life of a laboratory hermit devoted to the service of an obsolete research organization. Instead, I spent my first five years in India ascertaining by practical experience the principles underlying health in crops.

In order to give my crops every chance of being attacked by parasites, nothing was done in the way of prevention; no insecticides and fungicides were used; no diseased material was ever destroyed. As my understanding of Indian agriculture progressed, and as my practice improved, a marked diminution of disease occurred. At the end of five years' tuition under my new professors—the peasants and the pests—the attacks of insects and fungi on all crops, whose root systems were suitable to the local soil conditions, became negligible. By 1910 I had learned how to grow healthy crops, practically free from disease, without the slightest help from mycologists, entomologists, bacteriologists, agricultural chemists, statisticians, clearing-houses of information, artifical manures, spraying machines, insecticides, fungicides, germicides, and all other expensive paraphernalia of the modern Experiment Station.

Why Plants Are Attacked

I then posed to myself the principles which appeared to underlie the diseases of plants:

1. Insects and fungi are not the real cause of plant diseases but only attack unsuitable varieties or crops imperfectly grown. Their true role is that of censors for pointing out the crops that are improperly nourished and so keeping our agriculture up to the mark. In other words, the pests must be looked upon as Nature's professors of agriculture: as an integral portion of any rational system of farming.

2. The policy of protecting crops from pests by means of sprays, powders, and so forth is unscientific and unsound as, even when successful, such procedure merely preserves the unfit and obscures the real problem —how to grow healthy crops.

3. The burning of diseased plants seems to be the unnecessary destruction of organic matter as no such provision as this exists in Nature, in which insects and fungi after all live and work.

Health, the Key to Insect Resistance

This preliminary exploration of the ground suggested that the birthright of every crop is health, and that the correct method of dealing with disease at an Experiment Station is not to destroy the parasite, but to make use of it for tuning up agricultural practice.

Steps were then taken to apply these principles to oxen, the power unit in Indian agriculture. For this purpose it was necessary to have the work cattle under my own charge, to design their accommodation, and to arrange for their feeding, hygiene, and management. At first this was refused, but after persistent importunity, backed by the powerful support of the Member of the Viceroy's Council in charge of agriculture (the late Sir Robert Carlyle, K.C.S.I.), I was allowed to have charge of six pairs of oxen. I had little to learn in this matter as I belong to an old agricultural family and was brought up on a farm which had made for itself a local reputation in the management of cattle. My work animals were most carefully selected and everything was done to provide them with suitable housing and with fresh green fodder, silage, and grain, all produced from fertile land. I was naturally intensely interested in watching the reaction of these well-chosen and well-fed oxen to diseases like rinderpest, septicaemia, and foot-and-mouth disease which frequently devastated the countryside. None of my animals were segregated; none were inoculated; they frequently came in contact with diseased stock. As my small farm-yard at Pusa was only separated by a low hedge from one of the large cattle-sheds on the Pusa estate, in which outbreaks of foot-and-mouth disease often occurred, I have several times seen my oxen rubbing noses with foot-and-mouth cases. Nothing happened. The healthy well-fed animals reacted to this disease exactly as suitable varieties of crops, when properly grown, did to insect and fungous pests—no infection took place.

As the factors of time and place are important when testing any agricultural innovation, it now became necessary to try out the three principles referred to above over a reasonably long period and in new localities. This was done during the next twenty-one years at three centres: Pusa (1910-24), Quetta (summers of 1910 to 1918), and Indore (1924-31).

Insect Investigations

At Pusa, during the years 1910 to 1924, outbreaks of plant diseases were rare, except on certain cultures with deep root systems which were grown chiefly to provide a supply of infecting material for testing the disease resistance of new types obtained by plant-breeding methods. Poor soil aeration always encouraged disease at Pusa. The unit species of *Lathyrus sativus* provided perhaps the most interesting example of the connection between soil aeration and insect attack. These unit species fell into three groups: surface-rooted types always immune to green-fly; deep-rooted types always heavily infected; types with intermediate root system always moderately infected. These sets of cultures were grown side by side year after year in small oblong plots about 10 feet wide. The

(*Continued on page* 48)

How Safe Is Your Water?

A good well can protect you from disease.

(CONCLUSION)

By JEANNE PONTIUS RINDGE

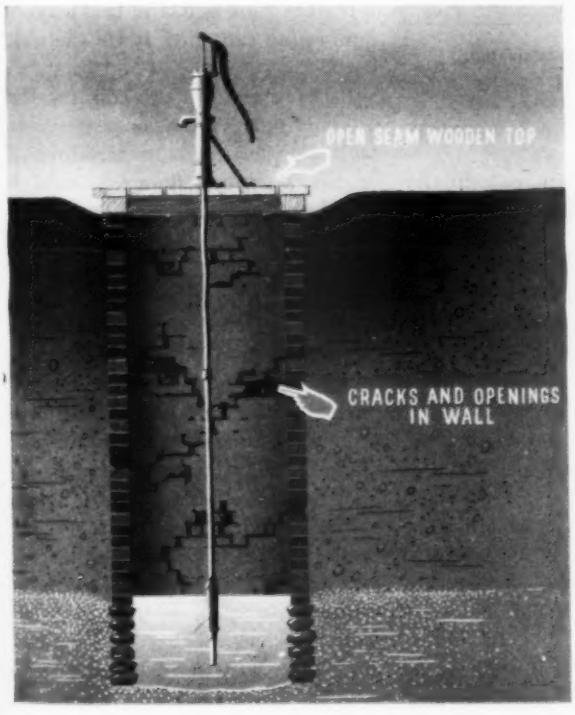
Photos by U. S. Public Health Service

WITHOUT water there can be no life. Every farmer is aware of this fact. Too often, however, he overlooks its corollary—wrong water can destroy life, or seriously impair it. Typhoid, dysentery, diarrhea and intestinal worms are only a few of the diseases which can be contracted through drinking water.

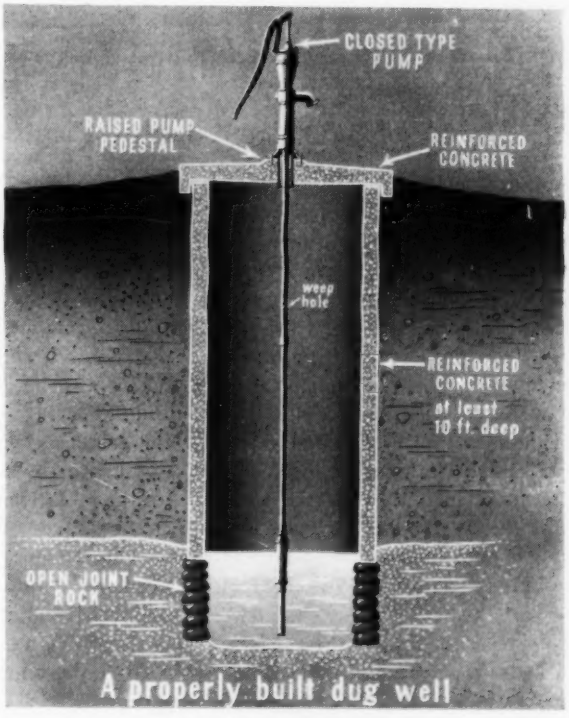
Nor will "any water" do for the livestock. Tuberculosis, hog cholera, anthrax, glanders, stomach and intestinal worms among animals, all are water-borne diseases.

In 1947 (the latest year for which figures are available) there were 23 major disease outbreaks due to contaminated water, affecting 5904 people. This data does not count the thousands of unreported ailments on individual farms which could have been traced, without doubt, to inadequate water supplies.

The National Inventory of Needs for Sanitation Facilities has made the appalling estimate that 75% of the rural homes with a water supply within 50 feet of the house are using unsafe water. (There are 1½ million homes which have no supply within 50 feet of the house.) Another survey shows 33 million rural



A BAD WELL AND...



A GOOD WELL.

Beware of the old oaken bucket. This type of well is easily contaminated.

How Safe Is Your Water?

Continued

Americans lacking in satisfactory sewage disposal facilities of even the simplest type. (900,000 homes have not even an outside privy.) Sewage disposal and safe water supply are joint problems.

A false sense of security is public enemy No. 1 of water purity. Water may be colorless, odorless and still contain millions of dangerous organisms. Disease-producing bacteria cannot be seen. *No source of water should be accepted as safe unless proved so by a laboratory test* (discussed last month) the Public Health Service warns.

Oddly enough the most scientifically built septic tank may be contaminating water which was perfectly safe when a privy stood on the same spot. The increase in the amount of water used also increases the possibility of contamination. For that reason, the most modern farms are often the most susceptible to impure water supplies.

A family recently moved to a farm which was the last word in modernism, including expensive equipment for keeping the barn sanitary. The house had three bathrooms, a stainless steel kitchen, and all the mechanical aids. The 129 foot driven well, tapping a limitless water supply, was "bound" to be pure—no impurities could reach that deep. Or so they thought.

After the family fell ill with diarrhea, the well was tested. It was found to be grossly polluted. Runoff from the septic tank was found to be draining into the soil directly above the direction of flow of the well water (although at a supposedly "safe" distance from the well). Because of the nature of the subsoil—mostly limestone—fissures evidently were present which permitted the vast quantities of polluted effluent from the septic tank to drop more than 100 feet without purifying itself.

It is a too-often accepted notion that "ten feet of filtration through subsoil will purify water". This is true only under certain soil conditions.

Safe water, with an adequate supply, should be the farmer's first consideration in buying a farm or constructing a well. Unfortunately, there are few rules which apply to all situations. A general understanding of the nature of water supply and contamination, plus knowledge of possible water systems available, is necessary, particularly so if an accredited public health engineer is unavailable to assist you.

To be certain of safety, you must be sure that your water is pure when it reaches your well, and that no contamination can enter it via the well itself.

In a few areas of this country, the ground water carries dangerously high (for health) concentrations of arsenic, selenium, fluorides, vanadium and boron. This, however, is rare. Lead, zinc, and copper may occur in water as a result of corrosive action on distribution pipes coated with this material. This should be guarded against.

Disease-producing organisms are the primary danger. Surface water near human habitation usually contains bacteria which normally inhabit the intestinal tract of warm-blooded animals, including man. These bacteria, members of the "coliform" group, may not be injurious in themselves, but they give warning that the dangerous bacteria, such as those from sewage wastes of people who have typhoid or other enteric (intestinal) diseases (or who still

carry the bacteria of these diseases after they have recovered) can be present at any time.

A rock formation which will yield water to your well or spring is called an aquifer. It may have "water table conditions" (tapping the natural zone of saturation, or ground water) or, if it is confined under an overlying bed of relatively impermeable rock, it is said to have "artesian" conditions.

The capacity of rock to transmit water depends upon its porosity and also upon the size and the interconnection of its openings. Coarse, clean sand and gravel; coarse, porous sandstones, the cavernous limestones, and the broken lava beds are the most productive aquifers. Silts and clays which have interstices too small to yield water are among the most unproductive materials. Silt and clay materials near the surface are less compact and may yield small supplies.

It is important to understand that ground water is usually in motion, moving from high to lower elevations. For sanitary security, sources of possible contamination (privies, septic tanks, cesspools, barnyards, old dry wells, sink holes, etc.) should not lie on land which slopes toward the well or spring.

The greater the pumping rate (as in the case of several families using one well, or of running water in both house and barn) the greater is the possible area of contamination. As water is pumped, a cone of depression is made in the water table, with greater resultant drainage toward the well from the surrounding area.

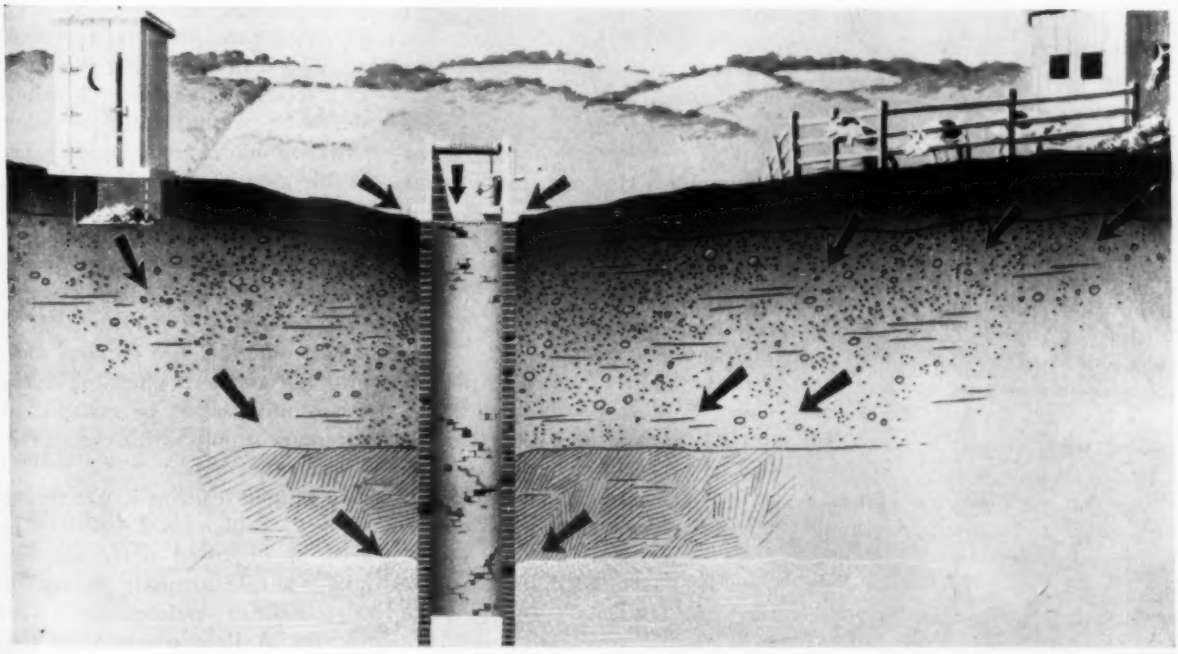
Artesian wells or springs are less apt to be contaminated because the constant pressure upward reverses the cone, and the impermeable strata of rock above the artesian aquifer acts as a block to ground water above. Artesian water can, however, be carried laterally for miles underground, and under certain conditions increase rather than decrease the bacterial count in the water.

For instance, some years ago in Elba, N. Y., an abandoned well was turned into a drainage pit for a septic tank. Wells for miles along a certain line became grossly polluted. The bacteria laden drainage was contaminating an underground stream which fed the wells. According to a Joint Committee on Rural Sanitation, "Formation such as coarse gravel, cavernous limestone, and broken lava rocks have such large openings that they are not effective as filters." The writer's well is fed by such an underground stream which could become contaminated as it passes beneath a small community four miles westward.

Sufficient sand and other fine-grained materials are generally effective in filtering out bacteria, if they extend well into the zone of water saturation.

It should be remembered that bacteria, carried downward by surface water, reach first the top zone of saturation, or water table, and are not likely to penetrate far below that level. A greater degree of security from contamination can be contained by constructing a well with a water-tight casing that extends a considerable distance into the normal water table .

Bacteria from privies, cesspools, and septic tanks are more apt than surface sources, to reach ground water level, because the excavations themselves often reach near, or even into, the water table. There also



An unsafe well because it is placed on low ground too close to sources of animal and human waste, and is not properly constructed.

How Safe Is Your Water?

Continued

(especially in the case of the septic tank) is an increase in the volume and push downward of polluted water.

Abandoned wells always should be filled, at least in the lower portion, with puddled clay (the lining also removed) and never should surface drainage be permitted to enter.

After careful study, the Joint Committee on Rural Sanitation suggests these minimal distances between water source and sewage areas:

"Pit privies, septic tanks, sewers, and subsurface pits, 50 feet; seepage pits, subsurface disposal fields, barnyards, 100 ft.; cesspools, 150 feet. Where area adjacent to water source is accessible to livestock the site should be enclosed by a fence, located in all directions, not less than 100 feet from the water source. Where drainage from barnyards or other areas used by livestock may reach the water source because of local topography or soil formation, a greater separation than 100 feet should be provided. All the above requirements are minimum distances and may be inadequate when all conditions are not favorable as in the case of creviced earth formations or very permeable soil. Requirements of State health departments concerned should be ascertained and observed."

Your well should be constructed so as to exclude surface water and ground water infiltration above the level of the water-producing formation. The following precautions should be taken: Earth surface should be sloped to drain away from the well, thus diverting surface water away from it. No accumulation of surface water should be permitted within 50 feet of well opening. Pump platform, pump-room floor, or cover of ground water supply should be located no less than 2 feet above the highest known high-water level or any nearby body of surface water.

For a well or spring on a hillside, an adequate ditch or ditches should be constructed on the uphill side of the well or spring so as to keep storm water at least 50 feet away in all directions. A well should not be located (or springs used) in ravines where storm water can come near them.

Pick Your Well, Then Build It Right

There are four types of wells: dug, bored, driven, and drilled. Most dug wells are less than 50 feet in depth and generally yield only small supplies from water-bearing materials near the top of the water table (area most apt to be contaminated).

Bored wells have similar depth and range in diameter from only a few inches where hand-operated augurs are used, to several feet where machine-driven augurs are used.

A driven well is construced by driving a pipe, usually fitted with a well point and screen, with the aid of a maul, drive donkey, or pile driver. It is used where water-bearing sand or fine gravel lie at comparatively shallow depths without intervening hard rocks or boulders. Under these conditions they can be constructed rapidly and at small cost.

A drilled well is constructed by making a hole with a drilling machine of any type and installing casing and screen where needed. This well has an advantage over the other three kinds as it is adapted to sinking holes in aquifers which may lie far below the water table. Yields therefore are larger, less affected by drought, and less apt to be contaminated.

Wells are cased to keep the hole open in formations likely to cave, to exclude contaminated surface water and rodents, and to seal off undesired water-bearing strata. Casing should extend at least 6 inches above the graded-up land surface of the well.

An overlapping, water-tight cover should be placed at the top of the casing or pipe sleeve to prevent contamination from entering through the annular opening at top. Every cover, pump platform or pump-room floor should be water tight and elevated above the adjacent land level. Its surface should be sloped to promote cleanliness. The cover of a dug well should be water-tight and should extend at least two feet from the well casing in all directions.

Don't Risk a Bad Well

If your existing well is subject to contamination due to faulty construction it should be rebuilt, or else a new well dug. Dug wells with brick or stone casing can often be rebuilt by enclosing existing casings with concrete or by use of buried concrete slab.

Before entering a well, it should be aired for several hours and a lighted lantern lowered into it. If it remains lighted, the well is reasonably safe from poison gas.

Springs used for drinking water should be enclosed by walls and covers made of concrete. These should permit spring water to enter unrestricted, but should exclude surface drainage and foreign matter. Water should be obtained from a discharge pipe rather than by dipper or bucket. The removable cover should be kept locked, if possible. All springs should be carefully tested for purity.

Under no circumstances, public health authorities warn, drink raw surface water (from streams, lakes, and ponds). These are becoming constantly more polluted. Dread polio as well as typhoid are traced to these sources.

Boil water for five minutes when in doubt about its safety. A chlorinating unit should be installed on any water supply which cannot otherwise be made safe.

If, without realizing it, you are one of the 27 million rural Americans in need of improved water supplies, failure to take adequate precautions can lead to unfortunate consequences. A silent, unseen killer may lurk in your water glass.

A Pennsylvania Oasis

Sleek horses and organic crops grow strong at Joseph Rodale's Arabian Stud.

By RAYMOND WHITELAW

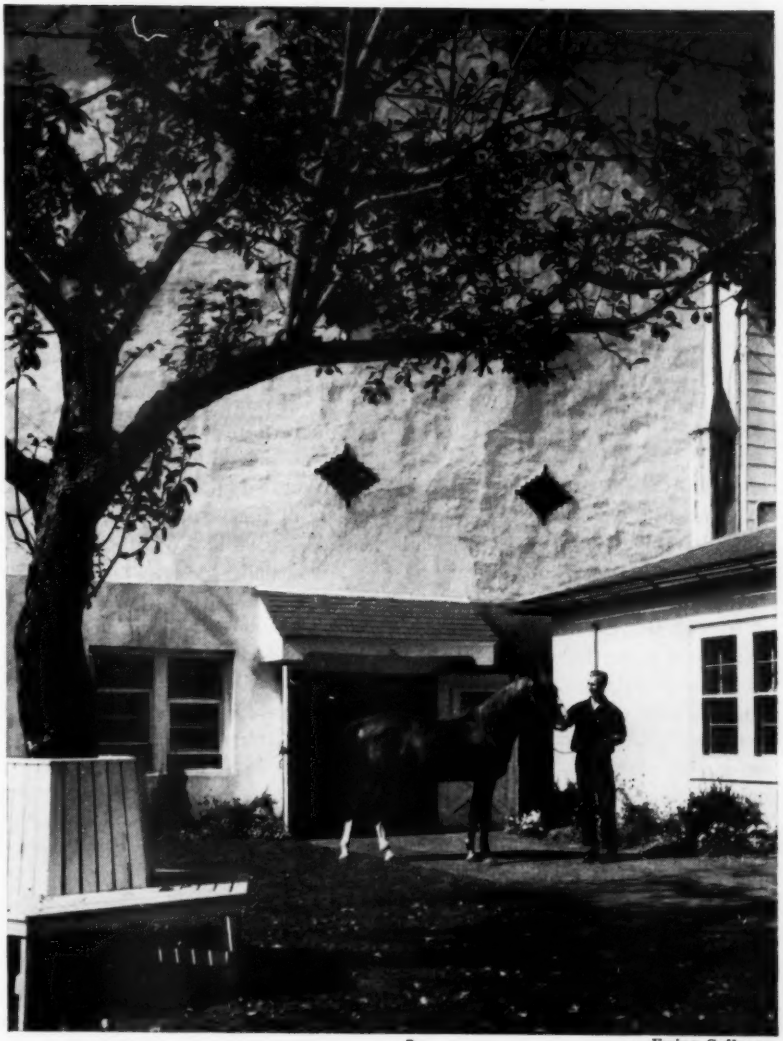
TO Joseph Rodale, brother of *Organic Farmer* editor J. I. Rodale, Arabian horses are the finest things on four feet. His love for these friendly horses is so great that he has developed his farm near Emmaus, Pennsylvania, into one of the finest Arabian breeding establishments in the East—and it's all Organic, too.

The 100 acre Rodale Arabian Stud supports an average of 30 Arab horses, with as many as a dozen foals being dropped in a year. Hundreds of visitors inspect the farm annually.

The Formation of an Idea

Joseph Rodale set an Arabian breeding farm as a goal when he served as a cavalryman under Pershing in Mexico. He lived in close touch with horses for several years, including a stay overseas in World War I. Arabians, the almost mythical horses of the desert, early seemed to him to be the best all around horse and he began planning to become one of the few breeders of these animals in America.

In 1945 he bought a good farm right next to the Organic Experimental Farm. The large stone barn was completely remodeled and fitted



Rosenthus, the chief sire of the Rodale Stud, and his trainer, Bob Kuhns.

—Ewing Galloway

Miss Jane Frohwitter of Allentown, Pennsylvania, and Alli Sidi.

A Pennsylvania Oasis

Continued

out with modern equipment. Its stalls comfortably handle the score and a half of horses.

One of the first Arabians bought —and he is still the head of the present string—was Rosenthus, a beautiful and mild mannered stallion imported from the stud of Lady Wentworth in England. Rosenthus has turned out to be an ideal horse. He is handsome and well conformed; a winner in many horse shows. He is as friendly and as playful as a puppy and extremely intelligent, having as extensive a bag of tricks as any kindergarten graduate. Several brood mares from Lady Wentworth's stud were purchased at the same time as Rosenthus. Other purchases and natural expansion have inflated the string to its present size.

An Organic Program

Actually, the Rodale Arabian Stud is a self-supporting and sustaining operation. All feed is raised right on the farm. Of course, no chemical fertilizers or pesticides have been used during the farm's present "administration."

A normal amount of labor is required to take care of the Organic phase of the farm's operations. Manure, available in ample amounts, is the basic fertilizer. It is sheet composted at practically any time during the year along with leaves, spoiled hay, weeds and other residue organic matter. Whenever weather prevents sheet composting, the manure is temporarily stored in piles.

About half the farm's acreage is allocated to fenced-in pasture. Portions of the pasture are occasionally planted to feed crops. The rest of the acreage is always used for feed crops, nothing but horses ever being sold off the farm.

Interesting changes in the health of the horses occurred as the farm's soil became more healthy because of its Organic treatment. Statistics kept faithfully of all births, deaths and miscarriages among the equine population show a remarkable decrease in the number of deaths at birth and reproductive disorders.

When operation of the stud was first begun, miscarriages and still births were numerous. No direct cause or a cure could be found. However, as the soil became more fertile and full of organic matter, health improved to such an extent that there were no deaths at all within the last few years. This is just another of the vast number of instances of human or animal health being influenced by soil condition.

Crop yields have also been improving—and without the use of weed killers or other drastic measures. Corn often hits 80 bushels to the acre, with oats correspondingly high.

Arabians an Excellent Choice

Joseph Rodale made a smart choice when he started breeding Arabians. He has had no trouble

disposing of his excess yearling. Rosenthus and his younger stallions have been in demand as studs. Arabians have always been popular as improvers of other breeds and bring high stud fees.

The gentleness, beauty and intelligence of these desert-bred horses makes them pleasant to associate with. Bob Kuhns, Rodale Stud trainer, has had no trouble at all making jumpers out of some of his charges. Now they shine in jumping events at shows all over Pennsylvania.

Some Rodale Arabs now grace the stables of prominent Americans. Arthur Godfrey's much talked about Arabian is a product of this Organic farm.

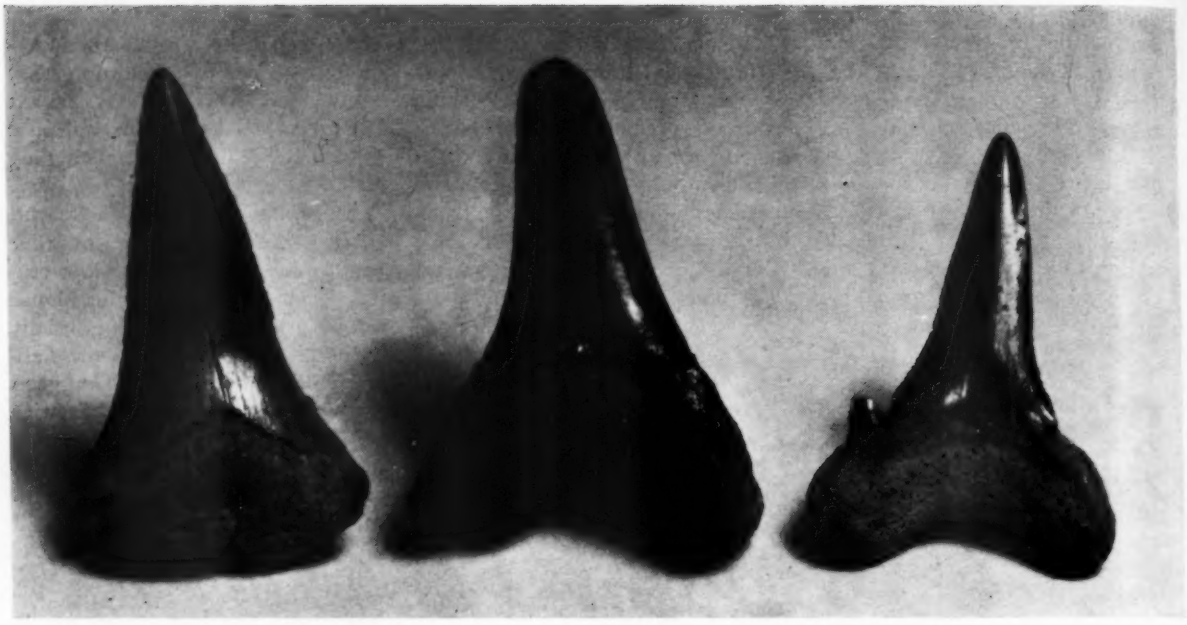
It has been reported that King Solomon was the first celebrity to take notice of the Arabian horse. In fact, he is supposed to be responsible for transferring the breed from Egypt, its original home, to Palestine and thence to Arabia. Descendants of the Arabian horse had been captured and domesticated by the Egyptian Kings as early as 1500 B.C. The Bedouins have been breeding and improving the Arabian, sold to them by Solomon, since the beginning of the Christian era, making it the oldest breed of improved livestock.

The Bedouins and other tribes of nomads were extremely respectful of their horses because they enabled them to make their living and ward off the enemy in desert warfare. It is interesting to note that the Arabians were the originators of artificial insemination. In time of war—an almost perpetual condition—they would sneak into the enemy camp at night and breed the staked-out pure bred mares with the sperm of plug stallions.

A distinctive and decidedly useful horse is the result of the intensive breed work done by the Arabs centuries ago. Today, the Arabian horse can be easily recognized, especially by its head, referred to as its "hallmark of authenticity." The good Arab has a slightly concave face with a chiseled appearance, small ears, a strong jaw, large nostrils and a bright, clear eye. A long, graceful neck, a short back, small feet and a pleasant gait are characteristic.

The mare Jawharah and the first foal of 1950, as yet unnamed.

Prince Abdullah chases an unidentified yearling while Marcellus looks on.



These shark teeth, shown 6 times actual size, were found in a deposit of potash-rich greensand.

Fertilizer

How to Get Potash.

Don't worry about potash deficiencies. They *can* be corrected organically.

By DR. WILLIAM H. EYSTER

THE replacement of soil potash has always been difficult for Organic Farmers. *Phosphorus* can easily be supplied in a natural way by rock phosphate and there is seldom a *nitrogen* deficiency in highly organic soil because humus is the farmer's best source of this element. However, there has been little publicity about or national distribution of an "acceptable" potash fertilizer. Organic matter can not always be relied on to replace this element, especially if it is produced on a soil low in potash.

Greensand and granite dust are two natural rock products supplying potash that are now or soon will be available to farmers at reasonable prices. Of the two, greensand is the best. It contains about 8 per cent potash compared to the 3 per cent of granite. However, when granite can be purchased cheaply its use is justified.

The more important agricultural values of greensand are summarized below:

1. It contains sufficient potassium and silica in available form to supply the demands of crop plants for these elements.

2. It contains a long list of trace elements which have only recently been found to be necessary for the growth of healthy crops.

3. It possesses the capacity of *base exchange*. That is, it has the ability to make nutrient elements on the soil available to the roots of crop plants.

4. It greatly improves the physical structure of certain soils.

5. It contains, besides potash, sufficient amounts of phosphorus to increase the yields of many crops.

The Availability of Potash in Greensand

Recent experiments by the bureau

of Plant Industry of the Department of Agriculture show that plants in their early growing stages will assimilate potash from greensand as effectively as from the usual soluble potassium salts. The experimenters used two sets of carefully controlled pot cultures of wheat and red clover with nutrient solutions. In one set the potash was supplied by the usual commercial salts; in the other set potash was supplied by greensand in proportions such as those employed in agricultural practice, all other sources of potash being excluded. It was found that the greensands from Virginia and New Jersey are able to supply sufficient potassium to satisfy the demand of Turkey Red wheat and red clover during the first two months of their growth. This enables them to make a greater growth, as determined by the weight of tops, than was seen in similar cultures in which the potassium demand was supplied by potassium chloride, sulphate and phosphate. The prompt availability of sufficient potassium to meet the needs of many, perhaps most, farm crops seems to be indicated.

It is reported that the New Jersey Agricultural Experiment Station has been working on the same problem and has reached similar conclusions. They found that greensand marl as a source of potassium gave increased yields in coarse white sand for barley and buckwheat, but the results with soybeans were about the same as the check cultures. When allowed to mature, there was an appreciable falling off in the yield of seed on the check pots, but the yield of stalks was about the same on the check pots.

J. R. Skeen, working under the supervision of Dr. R. H. True, reported that (1) greensands are a physiologically available source of potassium for plant growth, (2) no loss of potassium results from the addition of great amounts of greensand to the soil, as the unabsorbed potassium does not leach out of the soil, and (3) the average potassium-deficient soil should show marked improvement for several years after the addition of greensand.

The New Jersey Potash Mines Are Again Operating

The New Jersey greensand marls have long been known to contain small amounts of potash, lime, and phosphate. As reported by George Rogers Mansfield in a United States Geological Survey bulletin in 1922, greensand marls were dug and used as fertilizer for more than a hundred years. In the late sixties the amount so used amounted to about a million tons annually. With the introduction of artificial chemical fertilizers, the marl industry gradually died, but small amounts of greensand are still dug and used here and there. More recently, however, there has been considerable experimentation with greensands which indicate that they are far more valuable than has hitherto been realized.

The colors of greensands vary according to the mixtures of glauconite, clay, quartz, and other particles of which they are composed. The greensand beds are in general unconsolidated deposits consisting of variable proportions of glauconite grains, clay quartz, and small fragments of many other minerals. The glauconite grains range in size from less than one one-hundreth to more than one-twentieth of an inch. Some of the larger grains resemble casts of shells of Formanifera (one-celled marine animals having a shell composed of calcium carbonate or lime). In the deposits also occur such remains of larger marine animals as fossilized shark's teeth. These remains indicate that greensand marls were deposited in the sea, and contain in small amounts all the elements in sea water. It has been conservatively estimated that the New Jersey greensand deposits contain 256,953,000 tons of potash.

An Early Opinion of Greensand

In 1868 George H. Cook in his *Geology of New Jersey* summarized the values of greensand. He stated that the most valuable greensands are those which contain the largest percentage of phosphorus (phosphoric acid). In case available greensand didn't contain phosphoric acid, he emphasized that it could be converted into an active fertilizer by composting with quick lime. The crops particularly improved by it, according to Cook, are all forage crops such as grass, clover, etc.; potatoes, which are especially improved in keeping and eating qualities; buckwheat, which is stimulated to remarkable yields; and such grain crops as wheat, rye, oats and corn.

In short, Cook pointed out that greensand could be used in the growing of any kind of garden or field crop to the benefit of both the crop and the soil. It is free from seeds and weeds, and is dry and convenient to handle. "Greensand marl," he said, "has been of incalculable value to the country in which it is found. It has raised it from the lowest stage of agricultural exhaustion to a high state of improvement. Thousands of acres of land, which had been worn out and left in the commons, are now, by the use of greensand, yielding crops of the finest quality.

"Instances are pointed out everywhere in the marl district of farms which, in former times, would not support a family, but are now making their owners rich from their productiveness. Bare sands and pine barrens are converted by greensand into fruitful land."

Thomas Gordon of New Jersey wrote in 1830 that "it would be difficult to calculate the advantages which the state has gained, and will yet derive, from the use of marl. It has already saved some districts from depopulation, and increased the inhabitants of others, and may, one day, contribute to convert the sandy and pine deserts into regions of agricultural wealth."

Judge William P. Forman of Millstone township, Monmouth County, New Jersey, after 36 years experience with marl, says, "I look upon it as the foundation of my improvement in renovating a tract of worn out

How to Get Potash

Continued

land. It is worth one hundred and fifty per cent more than barnyard manure."

Dr. Keller of the University of Missouri has recently called attention to the shortage of potassium for agricultural purposes and has stressed the need for utilizing native rocks and natural deposits in replenishing the soil with minerals. "Where," he asks, "can we obtain sufficient potassium for all our present soil needs—and the continuing and mounting needs?" According to Keller, in 1944, a year of record potash production up to then, 652,260 short tons of potassium oxide were delivered for agricultural uses in the United States. This was hardly more than necessary for the cropland of the State of Mississippi alone, leaving none for the rest of the country.

Continued farming rapidly depletes everywhere the potash reserve our soils have inherited. According to Keller, in the year 1944 our corn crop took out of the soil 454,880 tons of potash, wheat extracted 169,716 tons of potash, and alfalfa 771,084 tons of potash. How shall this potash be replaced?

Potassium may be added to the soil by man in three ways; (1) as artificial commercial fertilizer, (2) as pulverized native rock or natural marine deposit such as greensand marl or other similar potash-containing materials, and (3) as compost made from materials containing potash.

The use of commercial fertilizers represents a short-range potash replacing program, and has so many deleterious effects on the soil that it cannot be recommended. Their high solubility unbalances the nutrition of plants, and they contain ions, such as chlorine and sodium, which change the physical nature and reaction of the soil. Highly soluble fertilizers overstock with a few elements the humus and clays, from which the plants accept their nutrients, thereby, suppressing, or blotting out entirely (for practical purposes) the availability of other elements also sorely needed by plants for optimum growth. By its over-concentration in some elements, such a fertilizer creates nutrient deficiencies in others—despite its purpose to correct deficiencies.

The trace elements iodine, boron, copper, cobalt, manganese, and others may not be supplied in the proper natural balance by man's too-narrow, selective, artifical replenishing. Until we know how to synthesize a fertilizer that will have in it all the essential elements in just the right amounts, we will do well to remineralize the soil by adding pulverized native rocks of mineral-rich deposits, such as greensand marl.

In this connection it is worth noting that greensand not only contains such major elements as potassium and phosphorus, but contains traces of the minerals from the sea in which it was deposited. Greensand shares with humus and clay the capacity of base exchange. This means that it is from humus, clay particles, and/or glauconite particles that plants accept their nutrients. Accordingly, greensand marl may be considered the best of all sources of potash to replace that which is being removed from the soil in cropping our gardens and farms.

The Importance of Potassium in Plant Nutrition

Potassium is absolutely essential for plants and cannot be entirely replaced by any other element. The exact role of potassium in plant nutrition is not known. It is present in comparatively large amounts in growing tips, and is essential to the formation of carbohydrates. It is believed to play a part in the assimilation of nitrogen and the formation of proteins. It appears to be necessary for the formation of oil in plants. It is known to play a controlling role in plant nutrition.

In a study of absorption by tobacco, T. R. Swanback made some observations on the effect of manganese on the absorption of potassium and calcium. The symptoms of manganese deficiency were most pronounced with low potassium supply, less with medium potassium supply, and not noticeable in the plants supplied with the highest concentration of potassium.

Some Recent Experiments With Potassium

Albrecht, Klemme, and Mierke, writing in the *Journal of the American Society of Agronomy*, found that potassium helps put more nitrogen into sweet clover. These authors report that, "While sweet clover is commonly considered the crop that can be established on most any soil by liming alone, after other and more desirable forage legumes have failed, one dare not forget that nitrogen delivery by this crop as well as its greater production of bulk calls for other fertility elements besides calcium and phosphate. There may be many elements among these, but certainly there is the suggestion from these studies on Putnam silt loam, a prairie soil, that potassium is important when the higher nitrogen content of the sweet clover crop is considered. After our soils are once heavily limed, this legume as a collector of nitrogen may need extra fertility elements in the soil, with potassium well near the top of the list."

According to E. R. Parker and W. W. Jones, fertilizers which supply potassium to the soil increased the size of orange fruits during a long-term experiment at Riverside, California. The increases in fruit size in this experiment were obtained by the application of potash and manure or other bulky organic materials. It is thought that the use of bulky organics gave greater yields because such materials create more favorable soil conditions as well as supply potassium.

John W. Sites has reported on the fruit symptoms of potassium deficiency as developed in the field in Flori-

(*Continued on page* 43)

Soil Robbers Penalize Themselves

It pays to apply the golden rule to your land

By WILLIAM P. COLEMAN

OUT our way, a neighbor who owns something like 200 acres of farm land but doesn't work it, spends his days puttering around although his physical condition is good. He lives on an old age pension check and occasional handouts from his grown children.

Another farmer in the same vicinity who is about the same age, looks after 15 acres of grapes, three acres of asparagus, and does practically all the work connected with raising feed for six milch cows and a team of good horses. He makes a living off his farm of 60 acres and is independent of everyone.

The first man has farmed himself right out of business, while the second has provided for security and independence in his old age. The latter will work until the day he dies, simply because he likes to work and enjoys raising good crops on good, fertile soil.

If he should ever want to take it easy, he can hire a man by the month or rent out the place on shares. Either way, his income would be assured. The land is fertile enough that many able men would jump at the chance to farm it.

He maintains semi-permanent hay fields of alfalfa, but every year at least one field is seeded to alfalfa or clover from which to take one cutting of hay. The second growth is plowed under. Corn is grown each year and he broadcasts rye and vetch just before the last cultivation for ground cover when the corn is removed, and which will be a green manure crop to turn under the following spring. Rye and vetch is sown in the vineyard for the same purposes.

In recent years, as this farmer's age forced him to slow up, weeds and grass occasionally take over a plowed field before he gets around to putting in a crop. That causes no worry. He just waits until the growth reaches a height of 12 to 18 inches, then hires a tractor plow to return the vegetation to the soil. This field is then seeded to alfalfa or clover at the proper time, and the tiny roots quickly find the succulent green manure crop that was recently covered.

As you may have surmised, this farmer raises more hay than he can feed. When the cows pick out the choicest bits of hay, he forks the coarse stuff out of the mangers and uses it for bedding for cows and horses. His cows appreciate the deep bedding that keeps them comfortable and clean in coldest weather, and they put the milk into the pail.

A lean-to shelters manure from rain, snow and wind. In early spring a neighbor brings over his manure spreader and draws the manure to the corn ground or the asparagus field.

This man raised the best potatoes for miles around and sold all he could spare to two grocery stores and to neighbors. Potatoes require fertile soil and he had it. His corn always made a good crop and was green when other farmers complained that their crop had badly fired.

Most farmers in the area shredded their corn fodder and used it for feed and bedding. He was one of the few who husked corn in the shock and then rebundled the fodder and left it in the field to protect the leaves until they could be plowed under.

The ex-farmer had six cows, too, and perhaps 150 chickens and a team. Shredded corn fodder was staple feed for his cows and horses, with a little poor hay added for good-measure. The animals never had enough to eat and they licked their mangers clean. Folks said that if a fork ever slipped from your hand

Soil Robbers Penalize Themselves

Continued

while feeding this stock, one of the cows would gulp it down.

"Pep is no feeder," they said. "He throws the poorest hay and corn fodder to his cows and as a result he can milk the six into the pail without ever emptying it."

Yes, he was a poor feeder and a poor worker, although he worked hard at times. But he was usually from two to six weeks late in getting his crops planted. He had no alfalfa or clover meadows, but depended each year on the last minute planting of some catch crop as rye, millet or sudan grass. They had so little time to make growth that it was hardly worth while to harvest them for hay. Then he would scout around and buy two or three tons of inferior hay that other farmers wouldn't take as a gift.

"Why don't you put out some alfalfa, Pep," he was asked time and again. "Build up the soil for a year or two in advance with green manure crops, and then get yourself a good hay field."

"Green manure cropping is a waste of land," was his inevitable reply. "I'd rather put the crop through the cows and plow under the manure. Do more good."

If he had just built up 10 out of his 200 acres and planted alfalfa, he would then have the best of hay. The cows would have paid for it over and over with rich milk and there would have been lots of manure and bedding to return to the soil. And by bedding deeply, he might have wiped out the mastitis in his herd.

The evils of soil robbing caught up with this farmer several years ago. He hit rock bottom and had to sell off his cows. He attempted a comeback in spring of 1949 with chickens, bought 100 day-old chicks and lost most of them within a few weeks. Disease continued to strike at his flock and he was glad to dispose of the balance at whatever the traveling poultry buyer would pay.

His chickens ran for years in the same small enclosure on bare, hard-packed ground. He had no chance to make a comeback on that disease-infested soil.

Today, Pep seats himself in a rocking chair when he isn't puttering and broods on the days that were. He sometimes griped about his misfortunes, but always blamed it on "this danged Michigan land." His neighbors practiced good methods on less fertile soil and made a good living.

"Poor old Pep," said one of the neighbors. "He certainly put in the hours and the labor, but he made his big mistake when he did the soil wrong. You can't succeed that way."

One of Pep's close neighbors did well on an 80 acre farm with eight milch cows, four head of young stock, a bull and a very good team. He raised plenty of good hay for his stock, enlarged the barn to provide greater mow capacity, yet each year had to erect a huge hay stack close to the barn.

Hay was so plentiful, the coarse stuff was used for bedding. "I'd rather have good hay than straw for bedding," he often said, "because the hay bedding when plowed under puts a lot of plant food into the soil."

Corn is husked in the field and the cows are turned in to browse on the leaves. Standing stalks are plowed under in spring, and no fodder is ever brought out of the field.

When a new alfalfa field is well established, the first cutting is removed from an old field and when the second growth reaches the height of twelve inches or so, the cows are turned in to pasture. After it has been pretty well grazed, the cows are returned to their old pasture, the field is plowed and worked and put into a cover crop. This is good farming and it is just the opposite of the practices of a next door neighbor on a 40 acre farm, once occupied by a 40 year old vineyard of 15 acres and a 40 year old, three acre asparagus patch.

This grape farmer began to farm the place 45 years ago, when he was full of ambition and energy. Every time he took a load of grapes to the juice plant, he returned with a huge load of manure which at that time was given gratis by lowland farmers to anyone who would draw it off the place.

The days of free manure finally came to an end, but the farmer did not seek out new sources of supply. Some neighbors bought one or more carloads of stockyard manure every spring, but not him. Others put in green manure crops to turn under in spring, but not him. He didn't even bother to sow a cover crop in the vineyard. His only livestock was a scrawny old horse, which was so poorly fed there was little manure which was left to deteriorate outside the barn door year after year.

Yearly, the productivity of vineyard and asparagus field declined. At one time the asparagus produced from $1500 to $1800 during the six to eight weeks harvesting season each year. The grapes in their heyday were good for sums ranging from $3,000 to $4,500 a year. Nine years ago, income had dropped so far that the grape farmer sold 10 acres to his good feeding neighbor.

Two years later, the neighbor paid for another 10 acre piece, and bought most of what remained in the following year, leaving a few rows of diseased grapes and the three acres of asparagus, now pretty much exhausted. It is years since pickers went down the grape and asparagus rows, and there isn't one cent in income on the place.

This man who was once considered an asparagus king and known to carry hundreds of dollars on his person, today lives on a small legacy. He is too old to look for work.

"Old Jake has gone down the road of poverty, like so many others before him," say the neighbors. "He could never be convinced that his permanent crops would ever give out."

A good many grape growers don't get much over one and one-half tons of grapes to the acre, but I knew one who consistently harvested from four to five tons. He believed in manure and green manure crops.

He kept all the dairy cows he had room for and the manure went on the grapes as often as a spreader load accumulated. He also bought from three to five carloads of manure from the Chicago stockyards each spring, and when this source was shut off he leaned heavier on green manure crops in the vineyard.

He never had a crop failure, pests and disease gave him little worry, and he more than maintained the fertility of his farm.

A friend of mine who farms some very light soil way back in the sand hills, keeps 14 head of milch cows, about eight head of young stock, a bull and two or three brood sows.

"How can you feed so much stock on your poor ground, Pete? I asked the other day when we met in town.

"Who told you we had poor ground?" he replied. "We set up a rotation of green manuring years ago and we never fail to get good crops of hay and grain."

"Can you raise good corn?" I asked.

"I'll say we can. Last year we had some of the nicest corn you'd want to see. Ran 87 bushels to the acre."

This in southern Michigan, a long way north of the corn belt. We used to think a man did well when his corn ran 30 bushels an acre.

It doesn't make any difference whether your soil is light or heavy or muck. Organic farming can improve it and enable you to harvest worth while crops with much less effort and acreage. And by the same token, without organic farming you are soil robbing yourself to the poorhouse and the day will come when the penalty is levied against you.

Keep your land fertile with turned under vegetation and you'll enjoy the only real security in the world—the independence of a free man with a sure, steady income.

With the Editor

(*Continued from page 9*)

crowding out the protein. The tendency is to go for bulk rather than quality I wish to suggest that the future of commercial fertilization is in the great rock wealth of our nation —a sleeping wealth worth billions upon billions of dollars and not being exploited. We can find phosphate rocks which are lower in phosphate than are now being used but full of other minor and trace elements. There are hundreds of different kinds of rocks which should be exploited. That's where to get the trace elements. Illinois has the right idea —they use only 1/15th as much superphosphate at they do phosphate rock in that state. Here is an astounding statement that recently came out of the University of Illinois. "The Unversity always has urged the use of straight materials instead of mixed fertilizers which are urged by the commercial companies. Ever since the time of Hopkins, the scientists have had a tough time with this idea because of the pressure of the commercial organizations."

There is much argument that these raw rocks are not available to the plant, but this is not so. Because of the fineness of the particle size they are available in sufficient quantities.

Neil W. Stuart, a government investigator at Beltsville, Maryland, discovered this in an experiment on rock phosphate he made upon which he commented as follows: "The plants get as much phosphorus as they need, without the necessity of adding costly phosphates to the nutrient solution." Yet an agricultural magazine boasted that they would accept no advertisements on phosphate rock.

In conclusion I would like to submit the work of Dr. W. D. Keller, agricultural geologist of the University of Missouri, who is closely associated with the famous Dr. Albrecht of that institution, in this work. In the February, 1948 issue of the *Scientific Monthly*, he actually attacks the use of chemical fertilizers, openly and by name, and suggests the use instead of ground-up rocks. He talks about the decline in productivity of soils impoverished by extractive farming. He says—quote—"Future replenishing of soil minerals will come advantageously and predominantly from relatively crude native rocks."

He talks of using chemical fertilizers as dosing the ailing soil patient. He says "Another serious defect of a highly soluble concentrated fertilizer is the powerful mass action effect it exerts to overstock with a few elements the humus and clay colloids from which the plants accept their nutrients, thereby suppressing the availablity of other elements also sorely needed by plants for optimum growth." He says further—"The plant food from the rock minerals is delivered slowly at a natural soil forming rate from within the soil body and not as a deluge of outside intoxicant."

Dr. Albrecht has been hinting at this for many years although he has never come out in such bold language as his close associate Dr. Keller, who wrote an article for a recent issue of *The Organic Farmer*.

It would take very simple experiments to grind up a dozen different kinds of rocks and see how they could feed plants. The value of this kind of fertilizer is that there are so many rock quarries and deposits distributed over the average state, that the product could be delivered by truck to nearby farms with an extremely low cost of trucking. Today a great part of the cost of chemical fertilizers consists of freight—because the raw materials have to come from great distances. Farmers of large acreage can buy a machine to crush their own rock.

So this is what we submit to American and world agriculture,—the use of some organic matter originating outside the farm area plus native rock fertilizers.

—J. I. RODALE

Memos To Farmers

Duplication of Research

America's agencies of defense have just announced, amid triumphant shouting, the development of miraculous mixtures capable of turning muddy battlefields and soggy beaches into solid ground that can support weights of 35 tons without cracking or buckling. What all the fuss is about I don't know. It's been known all along that chemical fertilizers will do the same thing.

New Virus Threatens Pigs

The Bureau of Animal Industry has reported the discovery of a hitherto unrecognized hog-cholera virus which causes infection shortly after the injection of the standard antiserum. Previously, only one hog-cholera virus was known to exist. The Bureau emphasizes, however, that both types of the disease can be prevented if the virus used in the serum is confined to the old type.

Pigs being fed garbage are extremely susceptible to this disease. (*see Books for more about garbage and pigs*) They catch it very easily by eating scraps of pork infected with the hog-cholera virus. It has been estimated that losses from hog-cholera have run as high as $65,000,000 in a single year.

Consequences of Beak Cutting

Preening by birds has been found by Dr. G. H. Bourne of London Hospital Medical College to be more of a health measure than a beautifying gesture. In an article in the scientific journal *Nature* he points out that a Chinese scientist found that birds get their vitamin D (the anti-rickets vitamin) from swallowing irradiated preen gland oil in the course of preening. Furry animals get this vitamin from the oil they lick off their hair.

In the light of the above facts, it would seem that the practice of cutting off part of the upper beak of cannibalistic birds could result in nutritional deficiencies. It is hard to imagine a bird with half a beak preening himself.

Heat Producing Ability of Grasses Tested

Extensive tests recently completed by the Pennsylvania Department of Animal Nutrition have shown that the ability of Kentucky bluegrass, orchard grass, bromegrass, alfalfa and timothy to produce body heat decreases in that order.

The caloric values of these hays was determined in two separate series of experiments. First, a constant amount of each grass was burned to determine the amount of heat it gave off. Then, the energy of sheep fed each type of hay was carefully calibrated. The data gathered in this experiment calls attention to the need to consider the energy producing value of your hay when planning rations.

More on Cannibalism

In the Letters department of last month's *Organic Farmer* Brother Louis Bertrand of Notre Dame told how he stopped cannibalism by feeding whole oats to his chickens. He has since written another letter about his methods of poultry raising, portions of which are printed below.

* * *

Two years ago, I started with 306 chicks. At the end of ten weeks there were 301 healthy, feathered and active chicks on range. This year I began with 531 chicks in one group. Tomorrow they'll be 6 weeks old and there are now 527 healthy, feathered and ambitious youngsters in a 12 by 16 foot coop. They are eating, besides growing mash, approximately six or seven pounds of whole oats a day.

To my layers I throw 5 pounds of vegetables per 100 birds per day in their deep—6 to 12 inch—litter. Carrots are best. They contain three times the amount of carotene that other vegetables do. If I don't have culls I give them good carrots. As a change I alternate with red beets, turnips, rutabagas and cabbage so as to have some vegetables before them every day.

My egg production remains a steady 60 to 65 per cent the year round. The carrots make the yolks and the egg in general outstanding in quality. I change all litter once a year, but keep replacing the wet litter around the fountains often.

Chemurgy a Poor Solution To the Surplus Problem

The National Farm Chemurgic Council is looking forward to the day when all automobiles will be powered partly by alcohol. They say that the use of grain crops for the production of fuel alcohol will be the answer to periodic crop surpluses.

Chemurgy—the use of crops for industrial purposes—is a poor solution to the farm surplus problem. Large conversion plants built in time of surplus will not be allowed to stand idle during bad years. No—farm land that should be being rebuilt as insurance against bad weather and population increases will be turned over to the production of chemurgic crops to supply with raw material those alcohol plants built during boom years.

At the moment, the problem of farm surpluses may seem to be of paramount importance. Nature, though, has the habit of indulging in a little "crop control" of her own once in a while, to the embarrassment of chemurgists and government planners alike. For evidence, read *Dust Again* on page 14. —R. R.

Fertilizer Teamwork

(*Continued from page* 21)

the other hand more mobile compounds of phosphorus with ammonia and potassium.

3. The third cause of the positive action of the manure on the phosphate flour is the dissolving action of nitric acid on the phosphate flour. This process essentially takes place after the introduction of the compost into the soil. The nitric acid is formed in the process of the nitrification of the manure ammonia.

This method of the compost treatment of manure with phosphate flour replaces to some extent the need for converting the phosphate into superphosphate. Also, it is possible to reduce the normal doses of manure 150 to 200 per cent without reducing yields. This means that the transportability of manure is increased by 1½ to 2 times.

The mixture in the pen of phosphate flour with the manure is also extremely valuable in that it makes possible the effective utilization of phosphate flour on any soil, including alkali soils, where the application of phosphate flour often shows little effectiveness.

Taking into account the presence in the Soviet Union of great deposits of phosphate rock, the compost treatment of manure with phosphate flour becomes of great importance.

In the new Five Year Plan, after that of the war, this method will have to be accorded the greatest possible attention.

* * *

These findings by the Russians are extremely significant and the practice of "composting" manure with rock phosphate should certainly be given a trial by American farmers. Especially intriguing is the statement that, by combination with manure, phosphate rock can become available when used on alkaline soil.

It is conceivable that the same method can be used to make other rock fertilizers, like granite dust and greensand, more effective. R. R.

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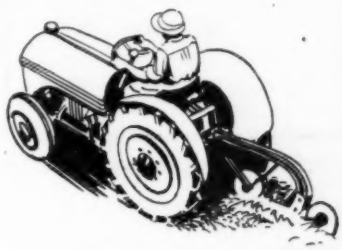

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Books

History of Piggery

Pigs from Cave to Corn Belt, Charles Wayland Towne and Edward Norris Wentworth, University of Oklahoma Press, $4.00.

Pigs from Cave to Corn Belt is an interesting and entertaining book for the general reader. As its title implies, it is a general account of the animal we know as the pig from its prehistoric ancestors right down to the highly developed meat producer of today. From its jacket design (a drawing by Rembrandt) through to its index, it is packed with pig anecdotes, history, trivia and useful information.

Unfortunately, though, the book comes to an end before the pig of today is treated in any detail. It would seem that these writers, with their readable style of writing and interpretation could have easily increased the value of their book a great deal by probing, for another 200 pages or so, into the life and times of the hog as he exists in his present environment.

Careful readers will note that there is no mention in this book of the pig as an agent of garbage disposal. A recent municipal engineering survey turned up the fact that 47 per cent of America's garbage is fed to pigs, making pig feeding the most popular disposal method. In other words, over 5 million tons of garbage pass through pigs, producing at least 2 million tons of pork. There is no doubt that health of the country is suffering, because it has been found that garbage fed pigs have four times as much trichinosis infection as their grain fed brothers and sisters.

Wanted

The Organic Farmer is seeking to add an assistant editor to its staff. Young men with farming and writing experience are invited to get in touch with us.

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Bedding is Cheaper Than You Think

Benjamin Manz

Pound foolish farmers are sometimes guilty of skimping on bedding. This nearly always results in lost liquid manure, discomfort for the animals, and unsanitary conditions. With the recently uncovered knowledge on the value of sheet composting, this practice is exposed as all the more foolish.

In computing the cost of bedding farmers are apt to neglect the value of the bedding itself as a fertilizer. The current value in dollars of the nutrients in plant residues, some of which are commonly used as bedding, varies from $3.50 to $5.50 per ton. The value in organic matter would be in addition. Besides this, the resulting savings in liquid manure mean additional nutrients.

This may mean that you are getting bedding for five dollars a ton instead of ten! If you can get straw cheaply, or produce plenty on your own farm, my advice is, don't use all you need, use all you can! Your land and livestock will both pay you for it. Also, think twice before you sell straw. Can you use more bedding, could you compost it, or could you leave it lay on the land and sheet compost?

Certain farmers are, however, confronted with the problem of obtaining enough bedding. Straw can be, and sometimes is, really expensive, no matter how you figure it. So why not substitute? Corn cobs ground up coarsely are a popular bedding for chickens. I only heard of them being used for hog litter once, but the farmer was enthusiastic about it. He claimed it superior to straw for farrowing houses. The cost of grinding would amount to about two dollars per ton. Since they are free the only other expense would be hauling. I believe they would work well as cattle bedding in pen barns and box stalls.

I once went through a steer barn where sawdust was used for bedding. The hired man told me the sawdust was warm even when wet. All through the timber belt there are sawmills turning out this excellent material by the ton, ready to use, and yours for the hauling.

If you are short on straw you might find it profitable to chop it as that increases its efficiency as an absorbing agent. However, I think in most cases it would be better to go out and find more bedding of some kind. It's the extra organic matter on your land that makes it pay.

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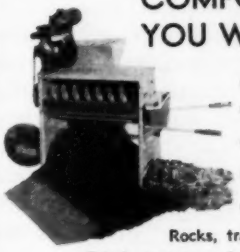
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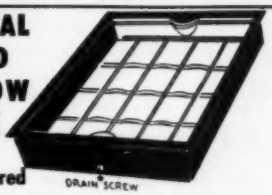

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Poultry

Sprouting Grain Improves Vitamin Content

by Jeanne Pontius Rindge

THE SPROUTING of grains increases their vitamin content materially. Those who like to experiment may have valuable results through the feeding of sprouted grain to poultry. Sprouts would be particularly valuable in the winter months when poultry is indoors and when the vitamin content of feed is at its lowest point.

Ten grains were recently tested for Vitamin B content after sprouting in sand cultures—Alpha barley, Victory oats, Cornell 34-53 corn, Tenmarque wheat, Bansei soy beans, mung beans, Alaska garden peas, large and small limas. After seedlings were harvested, dried and then ground, an assay was made.

Grain which had been sterilized for 30 minutes in calcium hypochlorite before sprouting lost some vitamin in the soaked seed, due probably to a leaching through action of the chlorine. After four days of sprouting, however, niacin, riboflavin, and biotin exceeded the initial concentration in the seed.

The best results were found when the seeds had been sprouted, without sterilization, directly in sand. In this case, riboflavin, niacin, biotin, showed large gains in the germinated seeds. There was little change in thiamin, but large increases in pyridoxine during early germination. As dehydration would destroy some Vitamin B, the greatest amount of good would derive from feeding sprouts fresh.

This would be even more true of Vitamin C. Various experiments with soy and mung beans indicate large increases of Vitamin C after sprouting. With soysprouts, the Vitamin C content more than doubled if the sprouts were kept at a temperature of 40-50° for one week after sprouting. Soybeans are a nutritious feed, high in protein, calcium, and iron—with the addition of stepped-up vitamin content through sprouting. The use of soysprouts as poultry feed would make an interesting, and possibly highly revealing experiment, particularly on the ordinary farm scale.

The Arkansas Experiment Station made tests for the hatchability, production, and fertility of eggs in which sprouted oats, added to a basic ration (including wheat bran, bran middlings, sprouted oats, yellow corn meal and meat scrap) compared favorably with the same ration to which minerals, or cod liver oil, or alfalfa meal were added.

Actually, the birds gained weight in the pen to which sprouted oats were added to the ration, while there was a slight loss of weight in the other pens (note that sprouted oats were used in base mash also).

Beans can best be sprouted in five gallon tins whose perforated bottoms are covered with a damp mat. After soaking several hours, place beans on mat and cover with similar mat. Place tins so that water can drain off easily. Sprinkle with water three times daily for four or five days before feeding.

Small grains can be sprouted most easily in moist sand, well drained, and watered often enough to keep grain always moist. Both beans and grain should be sprouted at room temperature.

A Poisonless Insecticide

by Jeanne Pontius Rindge

Ladies, everyone knows, find bright lights irresistible. It has taken a Purdue scientist to hitch this fact to insect control.

By waving bright lights before them, he is taking the ladies (in this case, the insect variety) to their doom. They literally are burned up.

This is a bit hard on the ladies in question, but may prove far safer to their human cousins than is the constantly stepped-up use of poison sprays. Not only is spraying dangerous from the point of view of human consumption, but also, the little bugs find ways of resisting the poison—or at least of producing children with the capacity to "take it". The new process may take care of the buglets—at least some varieties—once and for all.

The new insect killer is still in the experimental stage, but Dr. J. J. Davis and his cohorts in the Purdue University Department of Entomology (cooperating with the U. S. Dept. of Agriculture engineers) are using invisible "black light" as an insecticide.

Black light bulbs are placed in the fields during the known flight time of various insect moths. Just as gnats and mosquitoes are attracted to the porch light, so moths fly into the black light—bright to their sensitive eyes, but invisible to the farmer—and are annihilated.

Certain bands in the light spectrum seem to attract certain bugs, with the "women" finding them most irresistible. Moths of the corn borer, codling moth, corn earworm, boll worm, tomato and tobacco worms all are falling prey to this new technique.

The new method is not yet "on the market," although experimenters are getting good results with it. Practical methods of supplying the average farm have yet to be worked out.

If it comes soon, it could prove especially important to farmers of the middle west during the summer of 1950. Corn borers, which extracted a high toll in this area last year, are expected to return in increased numbers this summer.

L. H. Houck

Clarence Ahrens, Mt. Sterling, Mo., solved the problem of counter-balancing a tractor when using a heavy duty hydraulic loader by adding a 300 pound weight to the rear of the tractor. He used an old concrete block for the weight and fastened it to the hydraulic hitch by mounting the block on a wooden platform made to fit the holes in the hydraulic arms of the hitch. In this manner it could be attached or removed by using the hydraulic mechanism on the tractor which eliminated lifting. The chain kept the block from being jarred off when the tractor was in motion.

POTASH

(*Continued from page* 34)

da. He has shown in potassium-deficient grapefruit a definite reduction of soluble solids, total acid, and vitamin C in the juice.

S. M. Brown and D. S. Rayner found that potassium deficiency caused small oranges on 10-year-old bearing oranges growing outdoors under controlled conditions.

Commercial Sources of Natural Potash

Greensand can be purchased from the Kaylorite Company, 433 North Potomac Street, Hagerstown, Maryland and from National Soil Conservation, Inc., 90 West Street, New York, N. Y.

Granite dust, containing approximately three per cent potash, can be purchased from the North Carolina Granite Corporation, Mount Airy, North Carolina and from Bally Specialty Products, Bally 2, Penna.

Greensand costs from $15 to $30 per ton, and granite costs from $19 to $22 per ton.

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BASE EXCHANGE — For LAWNS, GARDENS, FARMS, apply directly to the soil or mix in the compost. It loosens clay, and binds sandy soils.

EASY to apply — For SHRUBS AND FRUIT TREES, apply liberally under the plant and as far out as the drip line. Especially recommended for remineralizing orchard soils.

Write for further information and prices.

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(See illustration)

The Keston Organic Shredder is basically a stationary unit. For your convenience it can be transformed into a handy portable (as illustrated, at slight extra cost) machine which readily shreds every kind of compostible plant materials into small particles that may be used in sheet composting or applied to the compost heap. These particles readily decompose, speeding up the composting process. Practical for all sized farms.
Built and guaranteed by a reputable manufacturer, the Keston works on an improved cutting principle that makes possible all-purpose shredding of wet, dry or decayed materials.
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The Market Place

Roto-Beater

Olson Manufacturing Co.

A machine that turns stalks or foliage into tons of rich mulch, shredded into readily-assimilated fertilizer form, has been developed by the Olson Manufacturing Co. Designated the Roto-Beater, this implement offers benefits to practically every type of farmer in every agricultural area.

It has been used by potato growers to pound potato vines into complete disintegration. In the top section of the photograph above is shown a swath cut through a potato field by the Olson Roto-Beater. It has been used for fragmentation of potato vines and asparagus growth, for topping onions, carrots and sugar beets, and for the disintegration of heavier foliage such as corn stalks, cotton stalks, weeds, green manure crops and others. The Roto-Beater is a hooded, tractor-drawn machine with 108 rubber flails or beaters mounted on a speedily-rotating cylinder. These beaters pound stalks, vines and the like into complete disintegration ready to fertilize the soil.

Ridemaster

Bolens Products Company

For farmers whose requirements range between garden and large tractors, Bolens Products Co. has developed the 725-pound Ridemaster. The Ridemaster is a four-wheeled vehicle, the two front wheels being closely spaced to give it the maneuverability of a tricycle. Turns within its own length — 83 inches — are easily effected. This reduces headland waste and improves close-quarter operations.

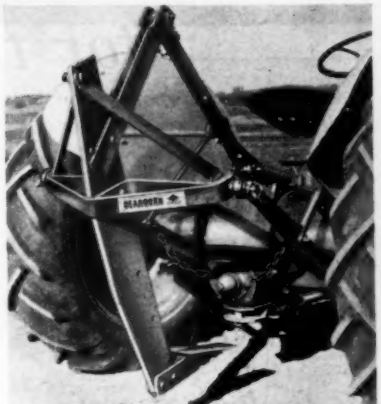
Low slung and stripped of all nonessentials, the Ridemaster has clean design that results in unusually good tool visibility. Front wheel drive gives better steering control and eliminates rear wheel side-slips. Many implements have been developed for

use with the Ridemaster—moldboard plow, disc harrow, multi-row seeder, spike-tooth harrow, a 20-inch disc plow, garden and field-type cultivators, and others.

Subsoiler

Dearborn Motors Corp.

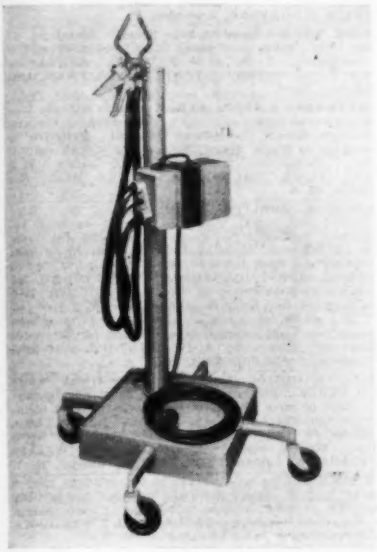
An improved subsoiler has been added to the Dearborn line of farm equipment. Designed to loosen packed or impervious subsoil, the Dearborn Subsoiler will operate to a depth of 15 inches or more. Special design of the beam permits it to run deeper with less draft. In seasons of long drought, on contoured land or in soil with an impervious hardpan, the Dearborn Subsoiler increases the water storage capacity and cuts down erosion. For more information



on the benefits of subsoiling see "Fertility is more Than Skin Deep" on page 22 of the March ORGANIC FARMER.

Portable Spot Welder
Allen Electric & Equipment Co.

The Allen Electric and Equipment Co. recently announced its new Model E-290 portable spot welder. The Model E-290 can be operated on or off the stand. It will



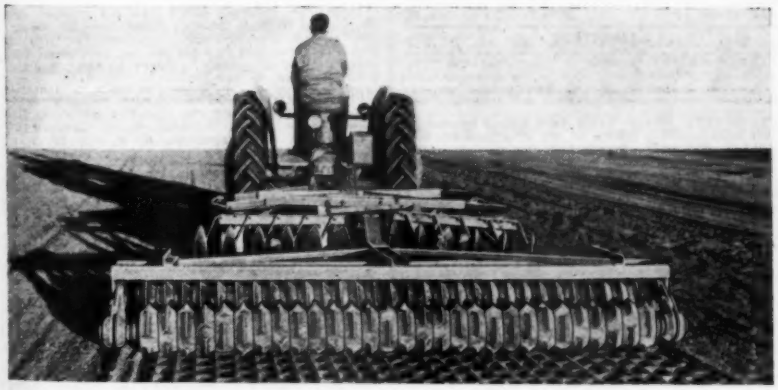
easily weld sheet steel up to a combined thickness of ⅛ inch. Lighter gauges of stainless steel can also be welded.

Multiwall Package
Hyper Humus Company

To prevent depreciation of their product in storing and shipping, the Hyper Humus Co. has developed a new package that assures the customer of a quality product. Hyper Humus, a natural soil organic, is

now available in a durable multiwall bag that is moisture proof and grease proof. Extensive tests have shown that this soil conditioner remains moist in the bags, that there is no loss in weight over a long period, and that extremely rough treatment causes no appreciable damage. Sizes of the bags are 20, 50, 80 and 100 pounds, and they may be ordered in mixed carload lots when desired.

Soilsaver: R. H. SHEPPARD CO., INC.



The R. H. Sheppard Co., Inc. has developed a new agricultural implement which pulverizes the soil and prevents erosion from wind and rain. Working on a revolutionary new principle, this implement provides a more even distribution of moisture in the subsoil. It has been named the Soilsaver.

The rear section of the Soilsaver, the wheels of which are cut away in four evenly-spaced intervals, builds tiny retaining walls over the surface of the entire field (see picture above). These walls trap the rainfall and hold it in place where it falls. This prevents wash off in the direction of low ground. A much longer "soaking in" period is afforded and more even distribution of moisture in the subsoil is assured.

The Soilsaver is a double-gang pull type implement and appears similar to the conventional pulverizing implement used on many farms today. A leveling drag, complete with weight boxes, is available for use between the sections of this implement. The frame of the Soilsaver is of all welded steel construction and it is equipped with roller bearings throughout. The center bearing has been eliminated entirely in the manufacturing process.

PREVENTION

A NEW MONTHLY MAGAZINE will be published under the editorship of J. I. Rodale of ORGANIC GARDENING Magazine, to be devoted solely to the conservation of human health, stressing exclusively the prevention of disease, not its cure. The name of the magazine will be PREVENTION. The only magazine of its kind ever published, it will be conducted on an extremely high plane. No advertising of medical or health products will be accepted, but PREVENTION will make editorial comment on products it feels worthy of mention.

Mr. Rodale's first interest was in the field of general health, and about eight years ago he was the publisher of "Health Guide". This magazine was discontinued so that he could concentrate on his new publication, Organic Gardening. But now, thousands of his readers have shown such an interest in health matters (and are continually writing to us for health information which we do not believe to be within the province of a gardening publication), that we feel it necessary to start this new publication, the material for which will be written by experts.

Organic Education in the Cities

We are starting PREVENTION for another reason. Through Organic Gardening and The Organic Farmer we are reaching farmers and gardeners, but we have no way of reaching the general public that neither farms nor gardens. In seeking circulation for PREVENTION Magazine, we will go into the cities. Thus we will have a means of describing the evils of chemical fertilization to an important new segment of the population, so that they can raise their voices in the accelerating movement against chemical fertilizers, poison sprays, and preservative poisons in foods.

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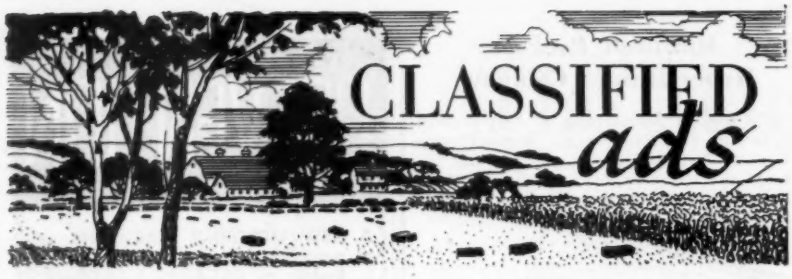

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UNIQUE INFORMAL STATIONERY. Twenty original drawings by 20 artists of Lehigh Valley. Fitting for all purposes. Size 3" x 4". Postpaid $1.25. **MRS. WILLIAM H. STEUGERWALD 213 S. 17th St., Allentown, Pa.**

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Rates are now 8c a word.

Minimum, 25 words, or $2.00

Payable in advance. Include name and address in word count.

The Organic Farmer does not accept advertising of artificial chemical products which it consideres deleterious to the land.

Deadline for classified advertising copy is 15th of month preceding date of issue. For instance, copy for the July issue is due June 15.

Make Money . . .

SELL YOUR ORGANICALLY-GROWN FOOD

There's a big demand for food grown by the organic method. If you grow more than you use, sell your excess supply by advertising in the classified columns of THE ORGANIC FARMER. You'll be surprised with the results.

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Health food—unprocessed—tree run sizes—no chemicals or commercial fertilizers—full of sugar—distinctive flavor—larger and better—**30c** per pound in minimum ten pound lots or more—charges *prepaid* anywhere in U. S. A.—no C.O.D.'s.

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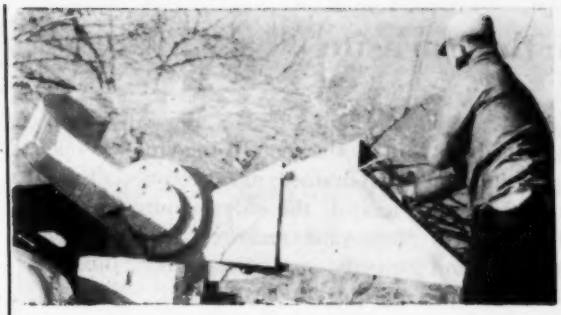

Brush Chippers Are Valuable to Orchardists

Farmers and orchardists who practice the organic method may soon be able to use brush or wood chippers to clear woodlots of debris while creating valuable mulching material at the same time. Several concerns are now manufacturing Chippers, although until recently these machines were used solely for disposing of twigs, branches and other wood scraps.

Twigs or branches are fed into the mouth of the machine and are immediately transformed into a spray of chips, the agricultural possibilities of which are considerable. Used as a wood mulch, these chips can become part of a long range fertilizing program. The farmer or orchardist can scarcely expect to see noticeable difference in the first year of mulching, for it takes time for the material to break down and become available. However, over a period of years he can be assured of a continuous supply of valuable humus.

Experiments are being conducted to determine whether these chippers can cut branches to a fineness that will permit use as bedding.

Restoring a Worn Out Farm

(*Continued from page* 13)

but the land will get continually better instead of being burned up and destroyed by the use of artificial fertilizers.

The Organic Culture opens up a wide frontier for us. It is real security. It is nature's method—relatively simple to carry forward once we have restored the cycle that was broken by our forefathers. The big expense is connected with interrupting the downtrend cycle and starting the land on the road to natural fertility.

For those of limited means, I would advise ground limestone first to sweeten the soil if necessary and provide a suitable environment for bacteria—then legumes and grass organic matter to feed the bacteria and provide green manures—then a permanent earthworm manure factory.

To accelerate the increase of your earthworm population I would compost corn cobs, old straw and hay with them and add as a top dressing on your fields on damp days. It allows them an opportunity to tunnel into the damp soil and lessens the chance of their drying out and dying on dry soil.

I have decided to use organiculture exclusively on my orchard, and it is my belief that many of the bacterial and fungus diseases now affecting our trees can be eliminated by growing healthy trees— trees that can build up enough resistance to throw off the disease.

This pretty well summarizes my efforts in rebuilding this farm. The land now grows luxurious grass; it has enough organic matter in its soil to mop up the rainfall, and erosion is no longer a problem. Readers are cordially invited to visit my farm whenever they're in the vicinity of Front Royal, Va. It's only six miles distant from the northern entrance to the Skyland Drive. Drop me a card and I will send detailed instructions on how to reach it.

Bees and Queens

Over 30 years a shipper

Pollinate your crops, double and thribble your seed production. Raise your own delicious

HONEY

Send for FREE CIRCULARS

BLUE BONNET APIARIES

WESLACO, TEXAS

Retreat Before the Parasite

(*Continued from page 24*)

green-fly infection repeated itself each year and was determined not by the presence of the parasite, but by the root development of the host. Obviously the host had to be in a certain condition before infection could take place. The insect, therefore, was not the cause but the consequence of something else.

One of the crops under study at Pusa was tobacco. At first a great many malformed plants—since proved to be due to virus— made their appearance in my cultures. When care was devoted to the details of growing tobacco seed, to the raising of the seedlings in the nurseries, to transplanting and general soil management, this virus disease disappeared altogether. It was very common during the first three years; it then became infrequent; between 1910 and 1924 I never saw a single case. Nothing was done in the way of prevention beyond good farming methods and the building up of a fertile soil. I dismissed it at the time as one of the many mare's nests of agricultural science—things which have no real existence.

For a period of eight years, I was provided with a subsidiary experiment station on the loess soils of the Quetta valley for the study of the problems underlying fruit-growing and irrigation. I observed no fungous disease of any importance in the dry climate of the Quetta valley during the eight summers I spent there. In the grape gardens, run by the tribesmen on the well-drained slopes of the valley, I never observed any diseases—insect or fungous—on the grapes or on the vines, although they were planted on the floors of deep trenches, allowed to climb up the earth walls and were frequently irrigated. At first sight, all the conditions for mildew seemed to have been provided, yet I never saw a single speck. Three favourable factors probably accounted for this result. The climate was exceedingly dry, with considerable air movement and cloudless skies; the soil made use of by the roots of the vine was open, well-drained, and exceptionally well aerated; the only manure used was farm-yard manure. Growth, yield, quality, and disease resistance left nothing to be desired.

The chief pest of fruit-trees at Quetta was green-fly soon after the young leaves appeared. This could be produced or avoided at will by careful attention to cultivation and irrigation. Any interference with soil aeration brought on this trouble; anything which promoted soil aeration prevented it. I frequently produced a strong attack of green-fly on peaches and almonds by over-irrigation during the winter and spring, and then stopped it dead by deep cultivation. The young shoots were covered with the pest below, but the upper portions of the same shoots were completely healthy. The green-fly never spread from the lower to the upper leaves on the same twig. The tribesmen got over the tendency of these loess soils to pack under irrigation in a very simple way. Lucerne was always grown in the fruit orchards, and regularly top-dressed with farm-yard manure. In this way the porosity of the soil was maintained and the green-fly kept in check.

At the Institute of Plant Industry, Indore, only two cases of disease occurred during the eight years I was there. The first occurred on a small field of grain (*Cicer aritinum*), about two-thirds of which was flooded for a few days one July, due to the temporary stoppage of one of the drainage canals which took storm water from adjacent areas through the estate. A map of the flooded area was made at the time. In October, about a month after sowing, this plot was heavily attacked by the gram caterpillar, the insect-infected area corresponding exactly with the inundation area. The rest of the plot escaped infection and grew normally. The insect did not spread to the other 50 acres of gram grown that year alongside. Some change in the food of the caterpillar had obviously been brought about by the alteration in the soil conditions caused by the temporary flooding. The second case of disease occurred in a field of *san* hemp (*Crotalaria juncea L.*) intended for green-manuring; however, this was not ploughed in but was kept for seed. After flowering the crop was smothered by a mildew; no seed was harvested. To produce a crop of seed of *san* on the black soils, it is necessary to manure the land with humus or farm-yard manure, when no infection takes place and an excellent crop of seed is obtained.

One experiment with cotton unfortunately could not be arranged in spite of all my efforts. At Indore there was a remarkable absence of all insect and fungous diseases of cotton. Good soil management, combined with dressings of humus, produced crops which were practically immune to all the pests of cotton. When the question of protecting India from the various cotton bollworms and boll-weevils from America was discussed, I offered to have these let loose among my cotton cultures at Indore in order (1) to settle the question whether these troubles in the U.S.A. were due to the insect or to the way the cotton was grown, and (2) to subject my farming methods to a crucial test. I am pretty certain the insects would have found my cotton cultures very indifferent nourishment. My proposal, however, did not find favour with the entomological advisers of the Indian Cotton Committee and the matter dropped.

At Quetta and Indore there was no case of infectious disease among the oxen. The freedom from disease observed at Pusa was again experienced in the new localities—the Western Frontier and Central India.

It was soon discovered in the course of this work that the thing that matters most in crop production is a regular supply of well-made farm-yard manure and that the maintenance of soil fertility is the basis of health.

The Trend is The Organic Way

These ORGANIC FARMER Books and Booklets Show You the *Why* and *How!*

You Should Own These Vital Publications for Organic Farmers

PAY DIRT

by J. I. Rodale

The best guide to the organic movement. Points the way to proper farming methods, shows how to obtain bigger yields of disease-free, health-giving crops. 252 pp. **$3.00.**

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AN AGRICULTURAL TESTAMENT

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The basic work which established the principles underlying the organic method. Louis Bromfield has said it is "the best book I know on the soil and the processes that take part in it." Used as a text-book, it will safely and surely bridge the gap for the novice between the use of harmful chemical fertilizers and organic methods, utilizing Nature's own laws and rhythms. 253 pp. **$3.50.**

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BIO-DYNAMIC Farming & Gardening

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A revelation in the vital biodynamic principles. The author calls attention to the more simple and natural methods of tilling the soil, planting, and harvesting. Comments are made on forestry, gardening, the dynamic activities of plant life, the relation of fertile soil to health, and results of bio-dynamic methods of farming based upon the return of all plant and animal residues to the soil. A work of genius. Paper, 240 pp., 18 illus. **$1.75.**

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EARTHWORMS—Their Intensive Propagation

by Dr. Thomas J. Barrett

Complete directions for the successful culture of earthworms, man's most important soil builder. The author, an authority on earthworm breeding, maintains an experimental research farm for the purpose of verifying claims set forth in this excellent book. Paper, 60 pp. **$1.00.**

THE ORGANIC FARMER LIBRARY

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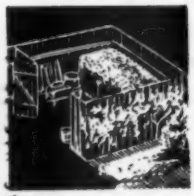

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